EFFECT OF DIFRERENT TILLAGE METHODS ON THE PERFORMANCE OF SOME COCOYAM VARIETIES IN AN ULTISOLS OF SOUTH EASTERN NIGERIA

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ABSTRACT
Effect of different tillage methods on the performance and yield of some cocoyam varieties was investigated at the research farm of the National Root Crops Research Institute Umudike during the 2006 and 2007 cropping seasons. The two-year trial was a 3 x 6 factorial laid out in randomized complete block design (RCBD) replicated three times. Results showed that among the Xanthosoma spp NXs 001 yielded significantly (P<0.05) higher than NXs 002 in terms of total yield. Also NXs 001 performed better in the three tillage methods than NXs 002. Neither tillage nor variety and tillage interactions were significant in 2006. The study, however, revealed that tillage methods did not significantly (P<0.05) influence total yield among Colocassia spp, in 2006. However, NCe 005 performed best in the three tillage methods followed by NCe 006 and NCe 001 in 2007. Concluding from the above results NCe 005 (Colocassisa spp.) and NXs 001 (Xanthosoma spp.) can be established using any of the three methods for cocoyam production.

INTRODUCTION
Cocoyams are believed to have originated from tropical America and have been under cultivation since pre-Columbian times (Thompson and Dewet, 1983). They were introduced into the West around 1840 (Shepherd, 1938, Coursey, 1968, Karikari, 1971, Doku, 1980). Cocoyams (*Colocassa esculenta* and *Xanthosoma maffafa (L))* are important carbohydrate staple food particularly in the southern and middle belt areas of Nigeria (Asumugha and Mbanaso, 2002). Among the root and tuber crops of economic value cocoyam ranks third in importance after yam and cassava in extent of production in Nigeria which is the largest producer of the crop and accounts for about 37% of total world output (FAO, 2006). Cocoyam is recommended primarily to diabetics and the aged (Ohiri *et al.*, 1970). It is also good food for children with allergy and for persons with intestinal disorders (Plucknet, 1970).

Tillage is, defined as physical, chemical or biological manipulations of the soil to optimize conditions for seed germination and seedling emergence and establishment (Lal, 1979). Soils are therefore tilled to produce the most suitable structure for plant growth and development. The tillage method chosen must fit into the entire soil management system of the particular crop to be grown. Cocoyam is produced under various tillage orientation systems among farmers in the cocoyam producing areas of Nigeria. Some systems are prone to problems associated with the effect of heavy rains, such as leaching and exposure of planted materials. It is of interest to investigate the effects of these methods on yield. The objective of this trial is to evaluate different tillage orientation systems for optimum cocoyam yield.

MATERIALS AND METHODS
The experiment was conducted during the two cropping seasons of 2006 and 2007 at the research farm of the National Root Crops Research Institute Umudike. Treatments consist of three levels of the tillage methods (mounds, ridges and flat) and six cocoyam varieties (NCe 006, NCe 001, NCe 003, NCe 005- *Colocassia spp), (*NXs 001, NXs 002- *Xanthosoma spp)*. Each plot size was 4m x 5m ($20m^2$) and plants were spaced at 0.5m on 1m ridges. The design was randomized complete block design (RCBD) replicated 3 times. Fertilizer NPK 15:15:15 was applied 8 weeks after planting at the rate of 400kg/ha. Yield parameters were subjected to analysis of variance (ANOVA) using Genstat Discovery Edition (2006) and significant means separated with Least Significant Difference (LSD) at 5% alpha level.

RESULTS AND DISCUSSION
The soils of the experimental sites in 2006 and 2007 were texturally classified as sandy clay loam with mean pH of 5.7. The result also showed low soil organic matter (OM) content, available phosphorus (P), potassium (K) and total Nitrogen (Table 1).The meteorological information of the area of the study is presented in Table 2. Rainfall was observed to be regular from the months of May to October for the two years of study with a corresponding high relative humidity. The months of September and August had the highest number of rain days in 2006 and 2007 respectively. It was observed that rain fall was moderate during the growing period with a little drought in the months of August and July in 2006 and 2007 respectively. The intensity of rain increased as the season progressed for both years of study. With the first few rains early in the season and the heavy rains later in the season, the soil remained appreciably moist for a long time.

In 2006 the *Xanthosoma* variety NXs 001 yielded significantly higher ($P<0.05$) than NXs 002. Neither tillage nor the variety and tillage interactions were significant (Table 3a). This is, however, similar to the result obtained by Igwilo and Ene (1982) in their study on the yield effect of planting yam minisetts on ridges, mounds and flat in the rain forest zone. They concluded that there were no significant yield differences between the different seed bed preparations. However, significant ($P<0.05$) yield differences existed between NXs 001 and NXs 002 in 2007 as in 2006. In terms of mean yield performance in 2007 NXs 001 performed better in the three tillage methods while NXs 002 yielded better on mounds and flats. Tillage methods in 2006 did not significantly ($P<0.05$) influence total yield among *Colocassia* varieties. However, interactions between variety and ridges were not significant. In 2007, NCe 005 (*Colocassia* spp) yielded better in the three tillage methods followed by NCs 006 and NCe 001.

The Umudike experimental site is low in organic matter (Table 1), which is a key factor in soil fertility (Mulongoy and Gasser, 1993). This may have contributed to relatively lower yields obtained in this trial when compared with up to 20 t/ha obtained in Hawaii (Onwueme, I. C. 1987). This condition is common to most humid tropical soils with low activity clays that are characterized by low cation exchange capacity and low productivity.

CONCLUSION

It was concluded from this study that the three tillage methods are ideal for cocoyam production using varieties NCe 005 (*Colocassia spp*.) and NXs 001 (*Xanthosoma spp*.).

Table 1: Some physical and chemical characteristics of the soil of the study site for 2006 and 2007

Physical Characteristics	**2006**	**2007**
Sand (%)	77.6	78.0
Silt (%)	9.2	8.3
Clay (%)	13.2	13.7
Chemical characteristics		
Mg cmol kg^{-1}	0.9	1.0
Ca cmol kg^{-1}	1.8	2.0
Na cmol kg^{-1}	0.2	0.1
CEC cmol kg^{-1}	3.3	3.6
Om (%)	1.0	1.4
N (%)	0.1	0.1
P ppm	6.0	7.8
pH	5.6	5.8

Table 2: Meteorological information for Umudike during the two years of study (2006, 2007)

Year of study	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov.	Dec.
	Average Monthly Rain Fall (mm)											
2006	76.3(3)	81.9 (3)	131.9 (6)	136 (9)	202.8 (15)	237.3 (15)	303.4 (16)	133.7 (15)	483.1 (20)	237.4 (19)	14.2 (1)	0 (0)
2007	0 (0)	62.9 (2)	35.5 (5)	78.4 (9)	444.9 (17)	354 (18)	187.6 (18)	464.8 (26)	319.9 (19)	335.6 (19)	112. (8)	25.0 (2)
	Average Monthly Temperature											
2006	33	33	34	33	31	31	30	29	29	31	31	32
2007	24	24	24	24	23	22	23	22	22	22	23	20
	Average Relative Humidity (%)											
2006	70.0	70.5	70.5	70.0	70.5	77.0	78.0	82.5	83.0	78.0	70.0	55.0
2007	36.0	59.0	56.0	56.0	71.0	74.5	79.0	81.5	78.5	77.0	74.0	63.0

+ value in parenthesis indicate number of rain days
Source: Agromet Dept. NRCRI, Umudike, Nigeria

Table 3a: Total yield of some *Xanthosoma* varieties (t/ha) as influenced by different tillage methods

	XANTHOSOMA					
	2006			**2007**		
	NXs 001	NXs 002	Mean	NXs 001	NXs 002	Mean
Mounds	2.80	2.40	2.60	3.60	3.00	3.30
Ridges	3.20	1.80	2.50	3.50	2.60	3.05
Flat	3.60	1.60	2.60	3.20	3.50	3.35
Mean	3.20	1.93		3.43	3.03	
LSD (0.05) Variety	0.56	0.56		0.32	0.32	
LSD (0.05) Tillage	NS	NS		0.39	0.39	
LSD (0.05) Variety x Tillage	NS	NS		0.55	0.55	

NS = Non significant at 5% alpha level

Table 3b: Total yield of some *Colocassia* varieties (t/ha) as influenced by different tillage methods.

	COCOCASSIA									
	2006					**2007**				
	NCe 006	NCe 001	NCe 003	NCe 005	Mean	NCe 006	NCe 001	NCe 003	NCe 005	Mean
Mounds	2.20	4.40	1.90	4.40	3.23	4.30	5.50	2.50	6.60	4.73
Ridges	3.30	4.00	1.70	5.20	3.55	5.20	3.80	2.50	5.90	4.35
Flat	2.80	3.00	2.20	2.80	2.70	4.10	3.50	2.50	4.60	3.68
Mean	2.77	3.80	1.93	4.13		4.53	4.27	2.50	5.70	
LSD (0.05) Variety	0.77	.077	0.77	.077		0.43	0.43	0.43	0.43	
LSD (0.05) Tillage	NS	NS	NS	NS		0.38	0.38	0.38	0.38	
LSD (0.05) Variety x Tillage	NS	NS	NS	NS		0.75	0.75	0.75	0.75	

NS = Non significant at 5% alpha level

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