IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 8, Issue 7 Ver. I (July. 2015), PP 06-13
www.iosrjournals.org

Post Harvest Rot of Cocoyams Obtained From Rivers and Bayelsa States of Nigeria.

Emiri, U.N.
Department of Agricultural Education, Isaac Jasper Boro College of Education, Sagbama, Bayelsa State Nigeria.

Abstract: *The incidence of Fungi on Post Harvest Cocoyam cultivars in three zones within Rivers and Bayelsa states namely, Coastal Plain Sands (Igbo and Baen), Warri Sombreic Deltaic Plain (Obrikom and Ahoada) and Meander Belt (Agudama and Kaiama) was studied. Four cocoyam cultivars were used for the study namely, Xanthosoma mafaffa (Ede uhie and Ede ocha) cultivars and a(Cocoindia and Ede nwachukwu) cultivars. The following micro-organisms of rot of the roots and corms (Cocoyam Decline Disease) were isolated. From X.mafaffaEde uhie, Mucor sp, Rhizopus stolonifer, Fusarium spand Aspergillus niger.Aspergillus flavus, Rhizopus stolonifer, Fusarium spand Aspergillus flavus were isolated from X.mafaffac.v Ede ocha. From C.esculentac.v (Coco India),Aspergillus flavus, Aspergillus niger, Rhizopus stolonifer and Mucor sp, while Mucor sp, Rhizopus stoloniferand Aspergillus niger were isolated from Colocasia esculentac.v. Ede nwachukwu.Most of the fungi isolated from the corms were present in the soil. Susceptibility of the cocoyam cultivars, X.mafaffa (Ede uhie and Ede ocha) and C.esculenta (Cocoindia and Ede nwachukwu) to the isolates of the corm rot pathogens was tested. The severity of the rot was highest in C.esculenta (coco india),X.mafaffa(Ede ocha),X.mafaffa (Ede uhie) and C.esculenta (Ede nwachukwu),X.mafaffa(Ede uhie and Ede ocha) and C.esculenta (coco india) were most susceptible to Aspergillus niger while C.esculenta (Ede nwachukwu) was most susceptible to Mucor sp.*

Key Words*: Corms; fungi;incidence; root rot;susceptible; tolerant; zones.*

I. Introduction

Cocoyams (Colocasia and Xanthosomaspp) are used as subsistence staples in many part of the tropic and sub tropic in Africa. The high carbohydrate content of cocoyam and its wide availability makes it a very good source of starch for both domestic and industrial uses in Nigeria and tropical Africa.

(Adabowale and Lawal, 2002b). World production of the crop is estimated to be 5.5 million tonne annually and provides about a third of the food intake of more than 400 million people in the tropics (FAO,1991). More than three quarters of the world cocoyam production come from Africa, with Ghana and Nigeria being the world leading producer. (Onwueme, 1982). However, report of a steady decline in production of the crop in Nigeria have been made since 1974 (Federal Office of Statistics, 1978) and an estimated loss of 40-50% of cormels has also been recorded (NRCRI, 1980).

This decline implicates post-harvest and field diseases as a constraint to production rather than lack of demand for the crop.(Arene and Okpala, 1981).Report on field diseases of Cocoyams have been made in Ishan-Ekpoma in Edo state of Nigeria since 1954, but in 1975 and 1977 the diseases were also recorded in Bori and Yenagoa in Rivers State of Nigeria (Arene and Okpala,1981). However, there are few data on the incidence of the diseases in the different zones within Rivers and Bayelsa States. Several researchers have reported soil microorganisms as the causal agents of root and corm rot of Cocoyam (Onuegbu et al., 1997; Arene andOkpala, 1981; Okeke, 1982; Maduewesi and Onyike, 1981; Nwufo and Fajola, 1981; Nwufo and Atu, 1987). However there is dearth of information on the Post-harvest rot of cocoyam s obtained from Rivers and Bayelsa States.

Objectives of the study

The objective of this work were, therefore to

1. Provide information on the micro organisms (fungi) responsible for the Post harvest rot of Cocoyams.
2. Compare the severity of rot in the different locations and zones of Rivers and Bayelsa States.

II. Materials And Methods

Location of the study.

The study was carried out in Rivers and Bayelsa in the Niger Delta agro-ecological zone of Nigeria. Two location per soil type were selected. These are Igbo-Etche and Baen; Ahoada and Obrikom; Agudama and Kaiama respectively from Coastal Plain Sand, Warri Sombreic Deltaic plain and Meander belt. Healthy Cocoyam (Xanthosomaand Colocasiaspecies) corms were used in the field and pathogenicity experiments were obtained from a farm at the Rivers State University of Science and Technology, Port Harcourt, Nigeria.

Isolation of fungi from soil samples.

Soil samples from five sites at 0-15cm and 15-30cm depths were collected from each location and placed into sterile polythene bags and immediately taken to the laboratory for isolation of microorganism and chemical analysis. The culture medium, Potato Dextrose Agar (PDA) was used in the isolation of fungi.

One gram of air-dried sample of soil at 0-15cm and 15-30cm depth were respectively added to 25ml sterile distilled water.The soil suspension was thoroughly shaken and serially diluted three (3) times. Each dilution was kept in Petri-dish. PDA was poured onto suspension and mixed thoroughly and allowed to set. They were left on the laboratory bench at 28 ± 1℃ for 4 days. Pure cultures of developing micro-organism were prepared and identified using a light microscope.

The fungi were identified on the basis of spore characteristics, colour, and the nature of hyphae. Viable counts were also made and recorded as colony forming unit (c.f.u.) after three (3) days of incubation.

Isolation of Fungi from Diseased Corm

Ten partially rotted corms of X.mafaffa (Edeuhie and Edeocha) and C.esculenta (cocoindia and edenwaschukwu) were collected from each location and placed into sterile polythene bags and immediately taken to the laboratory for isolation of micro-organisms of decay. PDA was used for this study. The corms from each location were washed in tap water for 10 minutes and then rinsed in distilled water.

The corms were surface-sterilized with 75% and 5% sodium hypochloride solution (1:1 ratio, vol/vol) for 15 minutes and then rinsed in sterile distilled water.

Slices of the corms starting from the "healthy" portion of the corms and sectioning towards the innermost zone of the advancing infection were made using sterile scalpel. From the innermost layer of the advancing infection in each corm, four thin slices (1 – 2mm) were taken and aseptically placed on sterile PDA and incubated at 28 ± 1℃ for four (4) days. Pure cultures of the fungal isolates were prepared and identified using light microscope, primarily on the basis of spore morphology, colour, and types of reproductive structures produced. (Barnette, 1965). Relationships were also observed among the variables studied.

Pathogenicity Studies

The pathogenicity of cocoyam isolated were made. Healthy cormels of Xanthosoma mafaffa (Edeuhie and Edeocha) and Colocasia esculenta (cocoindia and Edenwachukwu) were inoculated with cultures of these fungi separately and in combinations. The discs of the cultures were collected by means of 5mm diameter sterile cork borer. The disc were put into the 5mm hole bored by the sterile cork borer and finally sealed with Vaseline. The inoculated cormels were incubated at 28 ± 1℃ for 14 days at the end of which each cormel was cut longitudinally into halves and the extent of rot determined by two diameter measurements.

A mean of the two measurements of the three cormels was recorded as the amount of rot produced in each treatment.

The measurements were converted into modified rot indices of Arinze (1986) using the following ratings:

0cm	=	No rot
0 – 0.5cm	=	1
0.5 – 1.0cm	=	2
1.0 – 1.5cm	=	3
1.5 – 2.0cm	=	4
Above 2.0cm	=	5

Rot index (RI) therefore ranged from zero to five (0 – 5) in which zero represented no rot wherein 5 represented total degradation on the plant organ. Cormels inoculated with sterile 5mm discs of PDA constituted the control.

III. Results And Discussion

The results on incidence of fungi isolated from soils of various locations are shown in Table 1. Most of the fungi isolated from the three soil types studied have earlier been associated by several researchers as the causal agents of root and corm rot of cocoyam (Onuegbu and Chukwunda, 2001; Onuegbu et al., 1997; Arene and Okpala, 1981; Okeke, 1982; Maduewesi and Onyike, 1981; Nwufe and Fajola, 1981 as well as Nwufo and Atu, 1987).

Incidence of Fungi Isolated from Soils of Sampled Locations.

The fungi such as Aspergillus niger, Mucor, Penicillum sp, Rhizopus stelonifer, Aspergillus flavus, Scleretium rolfsii and Fusarium spp were isolated from the soil of Rivers State. Similarly, A. niger, Mucor, R.stolonifer, A. flavus and Penincilliumspp were isolated from the soils of Bayelsa State. A similar range of species were isolated from the soils at each location but more species were from the soil of Coastal Plain Sands compared with Warri-Sombreic Deltaic plain – WSD and Meander belt.

In general, the fungal species varied between zones and locations. For example in Coastal Plain Sands, S. rolfsii was isolated in one location (Igbo). Similarly, Fusarium sppwas isolated only from Baen.

Table 1: Incidence of Fungi Isolated from Soils of Six locations in Rivers and Bayelsa State, Nigeria.

Soil Type	Location	Organisms Isolated
Coastal Plain Sands	Igbo	Aspergillus niger
		Mucor
		Penincillium sp.
		R.stolonifer
		A. flavus
		Sclerotium rolfsii.
	Baen	A. niger
		Mucor
		Penincillium sp.
		R.stolonifer
		A. flavus
		Fusarium sp.
Warri Sombreic Deltaic Plain	Obrikom	A. niger
		Mucor
		R.stolonifer
		A. flavus
		Sclerotium rolfsii.
	Ahoada	A. niger
		Mucor
		R.stolonifer
		Penicillium sp.
		A. flavus
		Fusarium sp.
Meander Belt	Agudama	A. niger
		Mucor
		R.stolonifer
		A. flavus
		Penincillium sp
	Kaiama	A. niger
		R. stolonifer
		A. flavus
		Penicillium sp.

The results on the percentage incidence of micro-organisms (fungi) on harvest cocoyam cultivars is presented in Table 2. The type of fungi isolated from the corms of various cultivars differed and the percentage incidence varied across the locations.

Table 2: Percentage incidence of Fungi on Post Harvest Cocoyam cultivars across the Locations.

CULTIVAR/FUNGI ISOLATED		LOCATION					
		Igbo	Baen	Obrikom	Ahoada	Agudama	Kaiama
X.mafaffa c.v Ede uhie	Mucor	13.3	20.0	15.0	10.0	0.0	0.0
	R.stolonifer	33.30	35.0	55.0	0.0	0.0	20.0
	Fusarium sp.	0.0	20.0	0.0	5.0	0.0	0.0
	A. niger	0.0	5.0	10.0	5.0	15.0	5.0
	Penincillium sp.	0.0	0.0	0.0	0.0	5.0	0.0
	A. flavus	0.0	0.0	0.0	0.0	0.0	5.5
X.mafaffa c.v Ede ocha	Mucor	0.0	5.0	0.0	10.0	5.0	0.0
	R.stolonifer	20.0	20.0	25.0	25.0	10.0	25.0
	Fusarium sp.	0.0	20.0	0.0	5.0	5.0	0.0
	A. niger	0.0	5.0	5.0	5.0	20.0	0.0
	Penincillium sp.	0.0	0.0	0.0	0.0	0.0	20.0

	A. flavus	30.	5.0	15.0	0.0	25.0	10.0
C.esculenta c.v Coco India	Mucor	10.0	15.0	5.0	0.0	0.0	0.0
	R.stolonifer	65.0	30.0	47.5	10.0	10.0	5.0
	Fusarium sp.	0.0	0.0	0.0	0.0	20.0	0.0
	A. niger	10.0	6.67	0.0	5.0	5.0	5.0
	Penincillium sp.	0.0	0.0	0.0	0.0	0.0	10.0
	A. flavus	10.	0.0	12.5	0.0	5.0	10.0
C.esculenta c.v Edenwachukwu	Mucor	0.0	10.0	5.0	20.0	0.0	0.0
	R.stolonifer	6.67	15.0	25.0	10.0	10.0	15.0
	Fusarium sp.	0.0	0.0	0.0	5.0	0.0	0.0
	A. niger	0.0	5.0	5.0	0.0	5.0	15.0
	Penincillium sp.	0.0	0.0	0.0	0.0	0.0	10.0
	A. flavus	0.0	0.0	10.0	0.0	0.0	0.0

Most of the fungi isolated from the corms were present in the soil. Rhizopus stolonifer,Mucor spandFusarium spwere major pathogens of Edeuhie and were more abundant in Igbo, Baen and Obrikom plots. While Aspergillus flavus, R. stolonifer and Fusarium sp were major pathogens of Edeocha. R. stolonifer was predominant in all the plots, while Fusarium sp and A. flavus occurred more in Igbo, Agudama and Obrikom plots. The major pathogens of cocoindia and Edenwachukwu were R. stolonifer, Mucor and A. flavus. These were spread in all the plots.

Susceptibility of Cocoyam Cultivars to Fungi

The susceptibility of cocoyam cultivars to rot pathogens is shown in Figure 1.

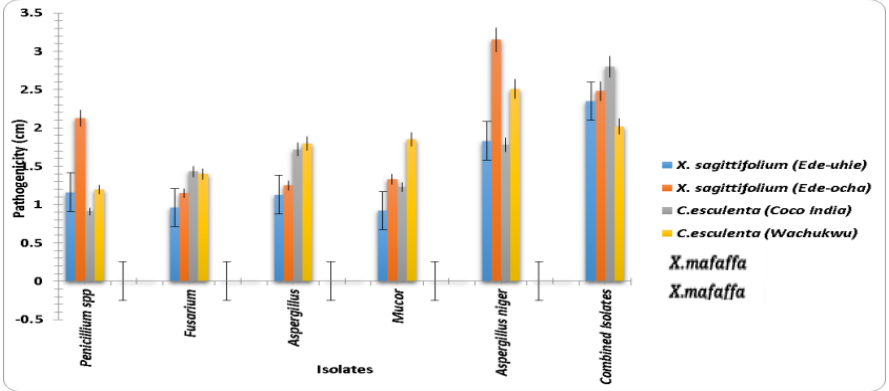
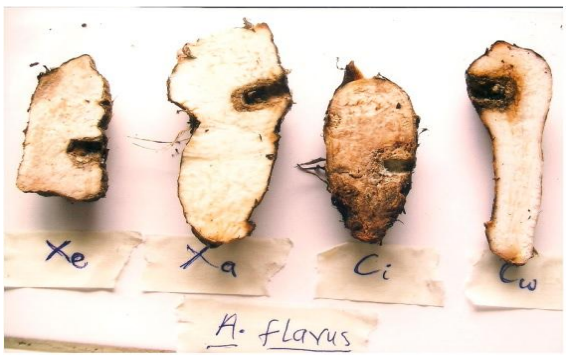


Fig 1: Severity of rot of Different Cocoyam Cultivars to Fungi

The result of susceptibility of Xanthosoma (Edeuhie and Edeocha) and Colocasia (Cocoindia and Edenwachukwu) cultivars indicates that Xanthosoma (Edeocha) was most susceptible when inoculated separately with each fungus while Colocasia (Cocoindia) was most susceptible when inoculated with a combination of isolates while Edenwachukwu appreared most tolerant. Edeuhie appeared more tolerant than Edeocha when inoculated with a combination of isolates.

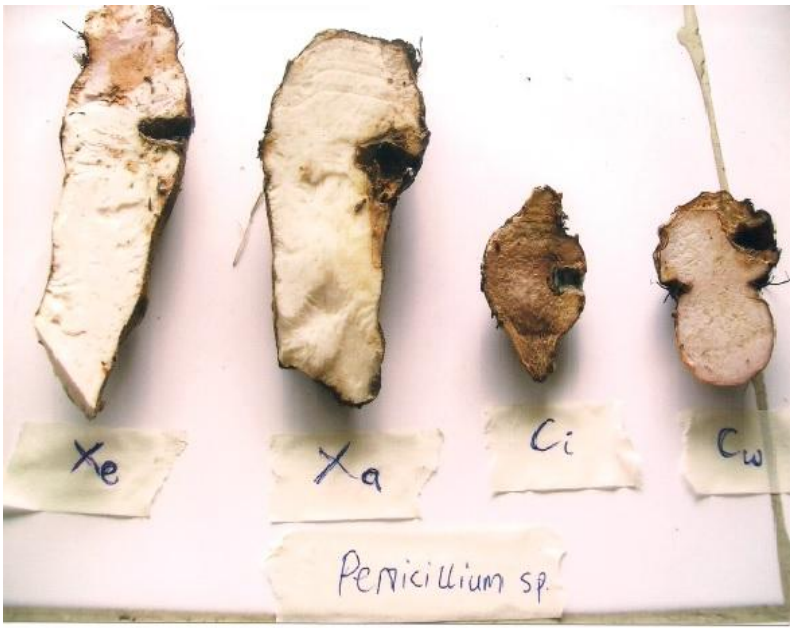


Xe	=	X.mafaffa	c.v.	Edeuhie
Xa	=	X.mafaffa	c.v.	Edeocha
C_i	=	C.esculenta	c.v.	Cocoindia
C_w	=	C.esculenta	c.v.	Edenwachukwu

Plate 1: Extent of rot of cocoyam cultivars inoculated with Aspergillus flavus.

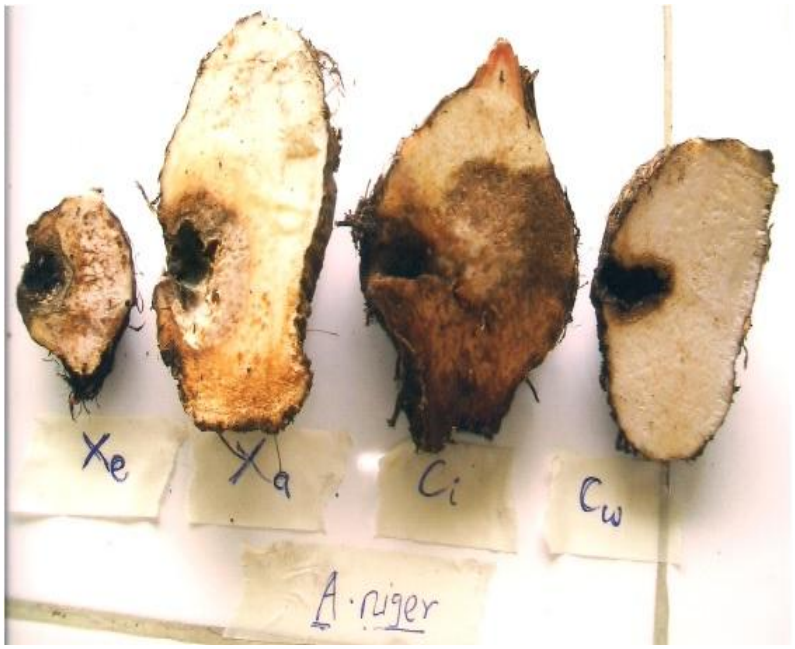
Xe	=	X.mafaffa	c.v.	Edeuhie
Xa	=	X.mafaffa	c.v.	Edeocha
C_i	=	C.esculenta	c.v.	Cocoindia
C_w	=	C.esculenta	c.v.	Edenwachukwu

Plate 2: Extent of rot of cocoyam cultivars inoculated with Fusarium spp.



Xe	=	X.mafaffa	c.v.	Edeuhie
Xa	=	X.mafaffa	c.v.	Edeocha
C_i	=	C.esculenta	c.v.	Cocoindia
C_w	=	C.esculenta	c.v.	Edenwachukwu

Plate 3: Extent of rot of cocoyam cultivars inoculated with Penicillum spp.

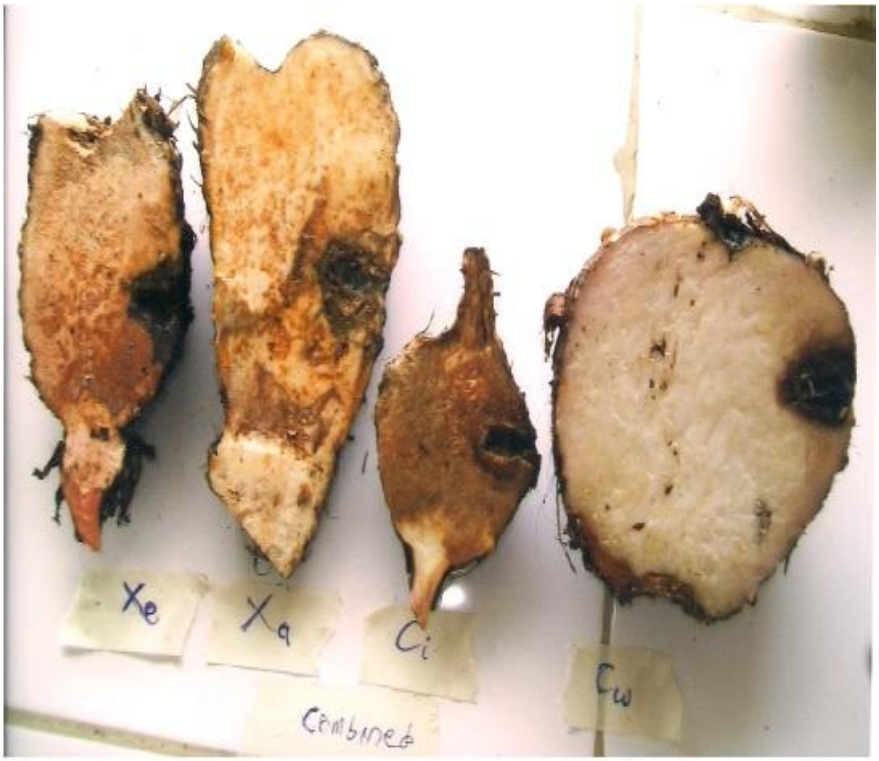


Xe	=	X.mafaffa	c.v.	Edeuhie
Xa	=	X.mafaffa	c.v.	Edeocha
C_i	=	C.esculenta	c.v.	Cocoindia
C_w	=	C.esculenta	c.v.	Edenwachukwu

Plate 4: Extent of rot of cocoyam cultivars inoculated with Aspergillus niger.

Xe	=	X.mafaffa	c.v.	Edeuhie
Xa	=	X.mafaffa	c.v.	Edeocha
C_i	=	C.esculenta	c.v.	Cocoindia
C_w	=	C.esculenta	c.v.	Edenwachukwu

Plate 5: Extent of rot of cocoyam cultivars inoculated with Mucor.



Xe	=	X.mafaffa	c.v.	Edeuhie
Xa	=	X.mafaffa	c.v.	Edeocha
C_i	=	C.esculenta	c.v.	Cocoindia
C_w	=	C.esculenta	c.v.	Edenwachukwu

Plate 6: Extent of rot of cocoyam cultivars inoculated with combination of isolates of rot organisms.

Xe	=	X.mafaffa	c.v.	Edeuhie
Xa	=	X.mafaffa	c.v.	Edeocha
C_i	=	C.esculenta	c.v.	Cocoindia
C_w	=	C.esculenta	c.v.	Edenwachukwu

Plate 7: Extent of rot of cocoyam cultivars uninoculated with any organism.

IV. Conclusion And Recommendation

This study showed that most of the fungi isolated from the corms were present in the soil. These fungi have been associated as the causal agents of root and corm rot of cocoyam Mucor sp, Rhizopus stolonifer, Fusarium sp and Aspergillusflavus were major pathogens of X.mafaffa (Edeuhie and Edeocha) and were abundant in some plots. The major pathogens of C.esculenta (cocoindia and Eenwachukwu) were R. stolonifer, Mucor and A. flavus. These were spread in all the plots (zones). Colocasia esculenta (Edenwachukwu) appeared most tolerant when inoculated with a combination of isolates. This research suggest that apart from C.esculenta being the most tolerant cultivar to Cocoyam root rot complex, the Meander belt holds promise for cocoyam cultivation in the Niger Delta geomorphological zones of Nigeria.

References

[1]. Adebowale, K.O., and Lawal, O.S. (2002b). Effect of annealing and heat moisture conditioning on the physiochemical characteristics of Bambara groundnut Voandzeia substerran starch. Nahrung/Food, 46, 311 – 316.

[2]. Arene, O. B. and Okpala, E. U. (1981) A Disease of Cocoyam in Nigeria caused by Corticium rolfsil. In: Tropical Root Crops: Research Strategies for the 1980s by Terry; E.R, Oduro, K.A. and F. Caveness (eds). Proc. Of the 1st Triennial Root Crops Symposium of the Intern. Soc. Trop, Root Crops, African Branch, Ibadan, Nigeria.

[3]. Barnett, H.L. (1965). Illustrated Genera of Imperfect fungi. 2nd Edition. Burgess Publishing Co., Minneapolis.

[4]. FAO. (1991). Qualerty Bulletin of Statistics of the Food and Agriculture Organization of the United Nations (Vol. 4).

[5]. Federal Office of Statistics (1978) Annual Report, Lagos, Nigeria.

[6]. Maduewesi, J.N.C. and Onyike, R.C.I. (1981) Fungal Rotting of Cocoyams Storage in Nigeria. In: Tropical Root crops: research Strategies for the 1980s. Proc. Of the 1st Triennial Root Crops Symposium of the Intern. Soc. For Tropical Root Crops. African Branch, Ibadan, Nigeria. Pp. 235 – 238.

[7]. National Root Crops research Institute (NRCRI). (1980). Annual Report, Umudike, Nigeria.

[8]. Nwufo, M.I. and Atu, U.G. (1987) Post-harvest rots of Cocoyams in Nigeria In Cocoyams in Nigeria; Production, Storage, Processing and Utilization by O.B. Arene; L.S.O. Ene; S.O. Odurukwu and N.O.A. Ezeh(eds). Proc. Of the 1st national workshop on Cocoyam, NRCRI, Umudike, Nigeria. Pp. 152 – 156

[9]. Nwufo, M.I. and fajola, A.O. (1981) Storage rot disease of Cocoyams (Colocasia esculenta) in South Eastern Nigeria. J. Root Crops, 7(182): 53 – 59

[10]. Okeke, G.C. (1982) Studies on the etiology and symptomatology of roots and storage rot disease of Cocoyam in Nigeria. Beitrage trop Landwirtsch, Veterinarmed, 20(3): 287 – 293.

[11]. Onuegbu, B.A; Adeniji, M.O; Zuofa, K. and Daniel-Kalio, L.A. (1997), Root and Corm rot of Cocoyams and Susceptibility of four cultivars of Cocoyams (Xanthosoma and Colocasia species) to microbial decay on Rivers State, Nigeria. African J. Root and Tuber Crops 3(1): 1 – 3

[12]. Onuegbu, B.A. (1995) Post-harvest pathology and Physiology of Cocoyams in Nigeria – A review Agric. Rev., 16(1): 1 – 6

[13]. Onuegbu, B.A. (1999). Composition of four cocoyam cultivars and their tolerance to corm rot. Trop. Science 39: 136 – 139.

[14]. Onuegbu, B.A. and Chukunda, F.A. (2011). Influence of some macro-elements, moisture and oxalic acid on rot of Cocoyam (Colocasia and Xanthosoma species). Int'l J. Crop Science 3(1): 10 – 14

[15]. Onwueme, I.C. (1982). The Tropical Tuber Crops. English language Book Society Chichester; John Wiley and Sons.