ANNUAL REPORT

OF THE

COCOA RESEARCH INSTITUTE OF NIGERIA, IBADAN.

2008

TABLE OF CONTENTS

PRINCIPAL ADMINISTRATION AND RESEARCH STAFF LIST AS AT 31 DECEMBER, 2008

Intenal Management Committee

S/NO.	NAME	DESIGNATION	QUALIFICATION
1.	Prof. G. O. Iremiren	Executive Director	B.Sc., M.Sc., Ph. D
2.	Dr. O. Olubamiwa	Director (R)	B.Sc., M.Sc., Ph. D
3.	Dr. E. O. Aigbekaen	Director (FSR&E)	B.Sc., M.Sc., Ph. D
4.	Dr. O. A. Fademi	Director (PB & T)	B.Sc., M.Sc., Ph. D
5.	Mr. J. O. Babafemi	Asst. Director (A & S)	B.Sc., M.PA, MNIM, ACIPM
6.	Dr. O. Oduwole	Hd,Plantation & Substation	B.Sc., M.Sc., Ph. D
7.	Mr. O. S. Adefaka	Asst. Director (F & A)	B.Sc., MBA, CMA
8.	Mr. Fagbami	Asst. Director (LID)	B.Sc., MLS
9.	Mr. K. M. Fabowale	Principal Accountant	OND, HND, PGD, ACMA
10.	Engr. A. T. Bakare	Snr. Maintenance Engineer	B. ENG., M.Sc.

PLANT PATHOLOGY

1.	Dr. (Mrs.) L. N. Dongo	B.Sc., M.Sc., Ph. D
2.	Dr. A. R. Adedeji	B. Sc. M.S., Ph. D
3.	Mr. A. H. Otunoye	B. Sc.
4.	Mr. S. Orisajo	B. Sc., M. Sc.
5.	Mr. M. O. Okeniyi	B. Agric.

PLANT BREEDING

1.	Dr. O. A. Fademi	B. Sc., M. Sc., Ph. D
2.	Dr. O. M. Aliyu	B. Sc., M. Sc., Ph. D
3.	Dr. P. O. aikpokpokdion	B.Sc., M. Sc., Ph. D
4.	Mrs. A. A. Muyiwa	B. Sc., M. Sc.
5.	Mr. K. E. Dada	B. Sc.

AGRONOMY

1.	Mrs. E. A. Adeyemi	B. Sc., M.Sc.
2.	Dr. L. A. Hammed	B. Sc., M. Sc.
3.	Mr. A. Oloyede	B. Sc., M. Sc. Ph. D
4.	Mr. K. O. Ayegboyin	B. Sc., M. Sc.

ENTOMOLOGY

1.	Dr. (Mrs.) F. A. Okelana	B. Sc., M. Phil.,Ph.D
2.	Mr. E. U. Asogwa	B. Sc., M. Sc.
3.	Mr. J. C. Anikwe	B. Sc., M. Sc.
4.	Mrs. I. U. Mokwunye	B. Sc., M. Sc.

SOIL AND PLANT NUTRITION

1.	Dr. R. R. Ipinmoroti	B. Sc., M. Sc., Ph. D
2.	Mrs. C. I. Iloyanomon	B. Sc., M. Sc.
3.	Mr. M. O. Ogunlade	B. Sc., M. Sc.
4.	Mr. M. A. Daniel	B. Sc., M. Sc.
5.	Mr. L. A. Adebowale	B. Sc.

CROP PROCESSING UTILIZATION

1.	Dr. O. Olubamiwa	B. Sc., M. Sc. Ph. D
2.	Mr. C. O. Jayeola	B. Sc., M. Sc.
3.	Mr. L. E. Yahaya	B. Sc. M. Sc.
4.	Dr. S. O. Aroyeun	B. Sc., M. Sc., Ph. D
5.	Dr. S. O. Ogunwolu	B. Sc., M. Sc., Ph. D
6.	Mr. A. A. Ajao	B. Sc. M. Sc.
7.	Mr. B. Adebowale	B. Sc. M. Sc.
8.	Mr. R. O. Igbinadolor	B. Sc., M. Sc.
9.	Mr. F. C. Mokwunye	B. Sc., M. Sc.

ECONS AND STATISTICS

1.	Dr. O. O. Oduwole	B. Sc., M. Sc. Ph. D
2.	Dr. R. A. Sanusi	B. Agric., M. Sc.,Ph.D
3.	Mr. T. R. Shittu	B. Sc. M. Sc.
4.	Mr. K. A. Oluyole	B. Sc., M. Sc.
5.	Mrs. J. O. Lawal	B. Agric., M. Sc.
6.	Mr. B. O. Obatolu	B. Agric., M. Sc.
7.	Mrs. M. Adejumo	B. Sc. M. Sc.

EXTENSION

1.	Dr. E. O. Aigbekaen	B. Sc., Ph. D
2.	Dr. S. O. Adeogun	B. Sc., M. Sc. Ph. D
3.	Mr. E. O. Uwagboe	B. Sc. M. Sc.
4.	Mr. E. A. Agbongiarhuoyi	B. Tech., M. Sc.
5.	Mr. S. Adebiyi	B. Tech.
6.	Mr. I. Ndagi	B. Agric.

HEAD OF STATION

1. Dr. S. O. Agbeniyi Ajassor
2. Dr. O. S. Ibiremo Owena
3. Dr. S. S. Omolaja Mambilla
4. Mr. Uloko Baba Adakole Ochaja
5. Mrs. U. N. Nmeregini Ibeku
6. Dr. A. O. Famaye Uhonmora

2008 NEW APPOINTMENT FOR SENIOR STAFF

S/N	NAME	POST	CONTISS	DATE OF ASSUMPTION	DEPLOYMENT
1.	Mofolasayo A. S.	Snr. Res. Officer	09	7/4/08	Fab. & Design
2.	OlorunmotaR.T. (Mrs)	Higher Agric. Supt.	07	7/4/08	Entomology
3.	Odedele S. O.	Higher Agric. Supt.	07	7/4/08	P/Breeding
4.	Oladunmoye A. A.	Higher Agric. Supt.	07	7/4/08	PEM
5.	Babalola E. A. (Mrs)	Higher Agric. Supt.	07	7/4/08	P/Pathology
6.	Abioye A. E.	Higher Agric. Supt.	07	7/4/08	PEM
7.	Babanitsa M.	Higher Agric. Supt.	07	7/4/08	Agronomy
8.	Orisasona T. M.	Higher Agric. Supt.	07	7/4/08	Agronomy
9.	Agbebaku E.	Higher Agric. Supt.	07	7/4/08	PEM
10.	Okunade O. O.	Higher Agric. Supt.	07	8/4/08	FSR & E
11.	Ogbugburu N. S.	Higher Agric. Supt.	07	8/4/08	P/Pathology
12.	Sobowale M. O.	Higher Agric. Supt.	07	9/4/08	Unhomora
13.	Edibo G.	Higher Agric. Supt.	07	9/4/08	Ochaja
14.	Wada S.	Higher Agric. Supt.	07	9/4/08	Ajassor
15.	Adegoke J. (Mrs.)	Higher Agric. Supt.	07	9/4/08	Owena
16.	Ojedeji O. A.	Higher Agric. Supt.	07	9/4/08	PEM
17.	Akanbi O.	Higher Agric. Supt.	07	9/4/08	SPN
18.	Adeniyi Y. A.	Higher Agric. Supt.	07	9/4/08	PEM
19.	Oladejo G. (Mrs.)	Higher Agric. Supt.	07	9/4/08	PEM
20.	Awodumila D. J.	Higher Agric. Supt.	07	9/4/08	Ext.
21.	Sulaiman W. (Miss)	Higher Agric. Supt.	07	10/4/08	Fab. & Design
22.	Ademola S. M.	Higher Agric. Supt.	07	11/4/08	Ajassor
23.	Oseghale G. E.	Higher Agric. Supt.	07	14/4/08	Ibeku

24.	Elugbe O. M.	Higher Agric. Supt.	07	14/4/08	Ochaja
25.	Emmanuel F. O. (Mrs.)	Higher Agric. Supt.	07	14/4/08	Ext.
26.	Etta N. M.	Higher Agric. Supt.	07	15/4/08	Uhonmora
27.	Suleiman I. E.	Higher Security Offr.	07	7/4/08	Security
28.	Ogunjobi T. E. (Mrs.)	Librarian	08	15/4/08	LID

2008 JUNIOR STAFF APPOINTMENT

S/NO	NAME	POST	CONTISS	DATE OF ASSUMPTION OF DUTY	DEPLOYMENT
1.	Adedeji kehinde (Mrs.)	Health Attd.	01	5/11/08	H/ Centre
2.	Ugi Pauline (Miss)	Sec. Asst. II	04	23/12/08	Ajassor S/S
3.	Abah Janet (Mrs.)	Health Attd.	01	31/12/08	Ochaja
4.	Alabi Y. B. (Mrs.)	Health Asst.	03	08/09/08	Owena
5.	Salami Ganiyu	Motor Driver	02	27/03/08	Owena
6.	Ibrahim Noah	Motor Driver	02	01/04/08	Ochaja
7.	Edim Okpokam O.	Storekeeper	03	10/04/08	Ajassor
8.	Isamaila Tajudeen	Motor Driver	02	06/06/08	Headquarters
9.	Muraina Luqman	Motor Driver	02	06/06/08	Headquarters
10.	Osungbade Ayoade	Motor Driver	02	06/06/08	Headquarters
11.	Arumeni I. Christian	Motor Driver	02	06/06/08	Headquarters
12.	Ogunkunle Gbadebo	Motor Driver	02	10/06/08	Headquarters
13.	Arowobusoye J. A.	Motor Driver	02	06/06/08	Headquarters
14.	Nome Peter	Motor Driver	02	10/06/08	Headquarters

2008 SENIOR STAFF PROMOTIONS

S/No	Name	Designation	CONRAISS	Date of Present Appt.	Promotable Post	Salary on Promotion	Recommended Effective Date
1	Dongo L. N. Dr. (Mrs)	Chief Research Officer	13	17/12/03	Asst. Director	14	1/10/08
2	Aliyu, O.M (Dr)	Prin. Research Officer	11	01/10/05	Chief Res. Officer	13	1/10/08
3	Aikpokpodion, P. O	Prin. Research Officer	11	01/10/05	Chief Res. Officer	13	1/10/08
4	Ibiremo, O. S. (Dr)	Prin. Research Officer	11	01/10/05	Chief Res. Officer	13	1/10/08
5	Ipinmoroti, R. R. (Dr)	Prin. Research Officer	11	01/10/05	Chief Res. Officer	13	1/10/08
6	Sanusi, R. A. (Dr)	Prin. Research Officer	11	01/10/05	Chief Res. Officer	11	1/10/08
7	Adeogun, S. O	Snr. Research Officer	09	01/10/06	Prin. Res. Officer	11	1/10/08
8	Iloyanomoh, C. (Mrs)	Snr. Research Officer	09	01/10/05	Prin. Res. Officer	11	1/10/08
9	Oluyole, K. A	Snr. Research Officer	09	01/10/05	Prin. Res. Officer	11	1/10/08
10	Ogunlade, M. O	Snr. Research Officer	09	01/10/05	Prin. Res. Officer	09	1/10/08
11	Agbongiarhuoyi, E. A	Research Officer Gd. I	08	24/11/04	Snr. Res. Officer	09	1/10/08
12	Uwagboe, E	Research Officer Gd. I	08	24/11/04	Snr. Res. Officer	09	1/10/08
13	Ayegboyin, K. O	Research Officer Gd. I	08	04/2/05	Snr. Res. Officer	09	1/10/08
14	Adebowale, B. A	Research Officer Gd. I	08	01/04/05	Snr. Res. Officer	13	1/10/08
15	Ogunbosoye, A. I	Asst. Chief Lab. Tech	12	01/10/05	Chief Lab. Tech	13	1/10/08
16	Anuforo, G. Z	Asst. Chief Agric. Supt	12	01/10/05	Chief Agric. Supt.	13	1/10/08
17	Adegbola, I. O	Asst. Chief Agric. Supt.	12	01/10/05	Chief Agric. Supt.	13	1/10/08
18	Adeyemo, G. O	Asst. Chief Agric. Supt.	12	01/10/05	Chief Agric. Supt	12	1/10/08
19	Eguntola, F	Prin. Agric Supt. I	11	01/10/05	Asst. Chief Agric. Supt	07	1/10/08
20	Imade, C. O	Agric. Supt.	06	01/10/05	Higher Agric. Supt	11	1/10/08
21	Busari, L. A (Mrs)	Prin. Statistical Offic. II	09	01/10/05	Prin. Statistical Offic. I	06	1/10/08
22	Adewumi E. O. (Mrs)	Lib. Tech.	05	01/10/05	Library Officer	12	1/10/08

23	Ubebe, P. A. (Mrs)	Prin. Admin. Officer	11	01/10/05	Asst. Chief Admin Off.	11	1/10/08
24	Onatunde-Onanuga, J. O	Snr. Admin. Officer	09	01/10/05	Prin. Admin. Officer	11	1/10/08
25	Oguntona, K. W	Snr. Admin. Officer	09	01/10/05	Prin. Admin. Officer	09	1/10/08
26	Adejoro, M. (Mrs)	Admin. Officer I	08	01/10/05	Snr. Admin. Officer	12	1/10/08
27	Adewumi, A. A	Prin. Executive Officer I	11	01/10/05	Asst. Chief Exec. Offic	12	1/10/08
28	Adebambo, F. T. (Mrs)	Prin. Executive Officer I	11	01/10/05	Asst. Chief Exec. Officer	09	1/10/08
29	Kuforiji, E. O	Senior Executive Officer	08	01/10/05	Prin. Exec. Officer II	08	1/10/08
30	Olubodun, O. O. (Miss)	Higher Executive Officer	07	01/10/05	Snr. Executive Officer	08	1/10/08
31	Modebei, T. S	Higher Executive Officer	07	01/10/05	Snr. Executive Officer	08	1/10/08
32	Oluwayomi, T. J	Higher Executive Officer	07	01/10/05	Snr. Executive Officer	08	1/10/08
33	Kuforiji, A. O. (Mrs)	Higher Executive Officer	07	1/10/05	Snr. Executiv Officer	08	1/10/08
34	Adeniyi, A. M. (Miss)	Asst. Executive Officer	05	1/10/05	Executive Officer	06	1/10/08
35	Okonkwo, U. K. (Miss)	Asst. Executive Officer	05	1/10/05	Executive Officer	06	1/10/08
36	Kareem, S.	Asst. Executive Officer	05	1/10/05	Executive Officer	06	1/10/08
37	Akhidime, M. O. (Mrs)	Asst. Executive Officer	05	1/10/05	Executive Officer	06	1/10/08
38	Opara, T. N (Mrs)	Asst. Executive Officer	05	1/10/05	Executive Officer	06	1/10/08
39	Olaoye, M. A	Snr. Clerical Officer	05	1/10/05	Chief Clerical Officer	06	1/10/08
40	Oaikhena, L. I (Mrs)	Snr. Clerical Officer	05	1/10/05	Chief Clerical Officer	06	1/10/08
41	Nmeregini, U.	Snr. Clerical Officer	05	1/10/05	Chief Clerical Officer	06	1/10/08
42	Bolarinde, F. A. (Mrs)	Snr. Clerical Officer	05	1/10/05	Chief Clerical Officer	06	1/10/08
43	Morakinyo, A. R	Senior Typist I	07	1/10/05	Chief Typist	08	1/10/08

	(Mrs)						
44	Ogbechie, M. O. (Mrs)	Senior Typist I	07	1/10/05	Chief Typist	08	1/10/08
45	Ogunsola, G. B (Mrs)	Senior Typist I	07	1/10/05	Chief Typist	08	1/10/08
46	Adedara, I. A (Mrs)	Senior Typist II	06	1/10/05	Snr. Typist I	07	1/10/08
47	Numfor, P. (Mr)	Typist I	05	1/10/05	Snr. Typist II	06	1/10/08
48	Onifade, E. O (Mrs)	Nurs. Sister/N/Supt	07	1/10/05	S. Nurs. Sister/N/Supt	08	1/10/08
49	Adebayo, J.B	Prin. Tech. Officer II	09	1/10/05	Prin. Tech. Officer I	11	1/10/08
50	Awe, J	Asst. Tech. Officer	05	1/10/05	Tech. Officer	06	1/10/08
51	Oduntan, S	Asst. Tech. Officer	05	1/10/05	Tech. Officer	06	1/10/08
52	Abah J.	Foreman	05	1/10/03	Snr. Foreman	06	1/10/08
53	Adeyanju, S.	Foreman	05	1/10/05	Snr. Foreman	06	1/10/08
54	Oyefi, J. A. (Mrs)	Asst. Store Officer	05	1/10/05	Store Officer	06	1/10/08
55	Assein, Oyahire	Asst. Chief S/Keeper	05	1/10/05	Chief S/Keeper	06	1/10/08
56	Mimba, E	S/M/Driver Mech. I	05	1/10/05	Chief. Driver Mech.	06	1/10/08

2008 LEFT THE SERVICE

S/N	Name	Designation	(CONTISS)	Deployment	Date of 1st Appt	Date of Exit	Mode of Exit
	R. A. Adeleke	Asst. Chief Agric Supt	13	P/Pathology	11/1/73	11/1/08	Length of Service
2.	J. Bamigbade	Chief Agric Field Overseer	06	PEM	12/2/73	12/2/08	Length of Service
3.	Mrs. S. Onarinde	Chief Agric Field Overseer	06	CPU	2/3/73	2/3/08	Length of Service
4.	Joel Orobiyi	Chief Agric Field Overseer	06	PEM	10/5/73	10/5/08	Length of Service
5.	O. R. Lawal	Asst. Chief Agric Supt	13	Extension	24/7/73	24/7/08	Length of Service
6.	Mrs. S. E. Akinrowo	Asst. Chief Agric Supt	13	Owena S/S	27/7/73	27/7/08	Length of Service
7.	Omolayo O.	Chief Agric Field Overseer	03	GMESS	1/12/97	18/8/08	Age
8.	Adekanola E. O.	Senior Security Guard	04	Security	1/9/93	2/8/08	Age
9.	Balogun F. A.	Head Security Guard	05	Security	1/7/81	12/9/08	Age
10.	Adewumi T.	Asst. Chief Agric Supt	12	PEM	17/9/81	17/9/08	Age
11.	D. D. Tokun	Chief Lab. Tech	13	CPU	4/8/75	26/11/08	Age
12.	Adekunle Ojo	Security Guards	03	Security	1996	26/9/08	Compulsory Retirement
13.	I. A. Adedeji	Chief Typist	08	Admin	16/2/77	7/9/08	Deceased
14.	Hamzat, R. A.	Prin. Research Officer	11	Ochaja	6/1/99		Withdrawal of Service
15.	Akintade Olotu	Security Guard	03	Owena	1/1/95	27/7/08	Deceased

2008 JUNIOR STAFF PROMOTIONS AND INTER-CADRE TRANSFER/CONVERSION

S/N	Name	Designation	CON TISS	Date Of Present Appt.	Post To Which Promotable	CONTI SS	Recommend ed Effect Date
1.	Adesina S.	Snr. Agric Field Overseer	4	1/10/2006	Asst. Chief Agric F/Overseer	5	1/10/2008
2.	Ethapemi, J.	Snr. Agric Field Overseer	4	1/10/2006	Asst. Chief Agric F/Overseer	5	1/10/2008
3.	Oguche, N.	Agric Field Overseer	3	2/1/2006	Snr. Agric Field Overseer	4	1/10/2008
4.	Kunuola, W. P.	Agric Field Overseer	3	1/10/2006	Snr. Agric Field Overseer	4	1/10/2008
5.	Asimi, O. T.	Agric Field Overseer	3	1/10/2006	Snr. Agric Field Overseer	4	1/10/2008
6.	Olaleye, O.	Agric Field Overseer	3	1/10/2006	Snr. Agric Field Overseer	4	1/10/2008
7.	Atanda, T. A.	Agric Field Overseer	3	1/10/2006	Snr. Agric Field Overseer	4	1/10/2008
8.	Adeleke, O. A.	Agric Field Overseer	3	1/10/2006	Snr. Agric Field Overseer	4	1/10/2008
9.	Okere, M. J.	Agric Field Overseer	2	1/10/2006	Snr. Agric Field Overseer	4	1/10/2008
10.	Onwudi, M. (Mrs.)	Agric Field Overseer	3	1/10/2006	Snr. Agric Field Overseer	4	1/10/2008
11.	Lukman, F. (Mrs.)	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
12.	Ogundare, O. R. A. (Mrs.)	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
13.	Fowosere, F. (Miss)	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
14.	Ariyibi E. (Mrs.)	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
15.	Ijadunola, T. (Mrs.)	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
16.	Adeyanju, S.	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
17.	Okere, F. (Mrs.)	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
18.	Makinde, B. (Mrs.)	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
19.	Ganiyu, J. (Mrs.)	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
20.	Ojo, B. (Mrs.)	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008

21.	Ugwoke, J.	Agric Field AttendantII	2	1/10/2006	AgriFOverseer	3	1/10/2008
22.	Komolafe, K.	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
23.	Nwaokolo, R. (Mrs.)	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
24.	Akinrelere, K. (Miss)	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
25.	Ajayi, Y. (Mrs.)	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
26.	Oyinlade, B. F. (Mrs.)	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
27.	Ojo, O. E. (Mrs.)	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
28.	Garba, I. A.	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
29.	Adetunji, E. (Mrs.)	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
30.	Adesida, V. (Mrs.)	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
31.	Olatunji, C. (Mrs.)	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
32.	Oladokun, J.	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
33.	Adetunji, T. A.	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
34.	Abioye, Peter	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
35.	Tijani, R. (Mrs.)	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
36.	Akinyomide, O.	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
37.	Ilori, V. O.	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
38.	Oladoja, O.	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
39.	Makinde, K. O.	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
40.	Oladunmoye, O.	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
41.	Umuahion, A.	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
42.	Lawal, A. J. (Mrs.)	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
43.	Edet, R. A.	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
44.	Olaoye, A. (Mrs.)	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
45.	Aribido, M.	Agric Field Attendant II	2	1/10/2006	Agric Field Overseer	3	1/10/2008
46.	Adepoju, O. (Mrs.)	Agric Field Attendant II	2	1/10/2006	Agric Field Attendant I	3	1/10/2008
47.	Olayiwola, A.	Agric Field Attendant II	2	1/10/2006	Agric Field Attendant I	3	1/10/2008
48.	Agboluaje, G.	Agric Field Attendant II	2	1/10/2006	Agric Field Attendant I	3	1/10/2008

49.	Jayeade, A.	Agric Field Attendant II	2	1/10/2006	Agric Field Attendant I	3	1/10/2008
50.	Adeyemi, O. (Mrs.)	Agric Field Attendant II	2	1/10/2006	Agric Field Attendant I	3	1/10/2008
51.	Lawal, B. (Mrs.)	Agric Field Attendant II	2	1/10/2006	Agric Field Attendant I	3	1/10/2008
52.	Emaku, M. (Mrs.)	Agric Field Attendant II	2	1/10/2006	Agric Field Attendant I	3	1/10/2008
53.	Alao, G.	Agric Field Attendant II	2	1/10/2006	Agric Field Attendant I	3	1/10/2008
54.	Gbadamosi, M.	Agric Field Attendant II	2	1/10/2006	Agric Field Attendant I	3	1/10/2008
55.	Oseghe, F. (Mrs.)	Agric Field Attendant II	2	1/10/2006	Agric Field Attendant I	3	1/10/2008
56.	Alalade, L. O. (Mrs.)	Agric Field Attendant II	2	1/10/2002	Agric Field Attendant I	3	1/10/2008
57.	Oloyede, K.	Agric Field Attendant II	2	1/10/2002	Agric Field Attendant I	3	1/10/2008
58.	Taiwo, B. (Mrs.)	Agric Field Attendant II	2	1/10/2000	Agric Field Attendant I	3	1/10/2008
59.	Gbiye, E. O. (Mrs.)	Agric Field Attendant II	2	1/10/2001	Agric Field Attendant I	3	1/10/2008
60.	Ojo, M.	Agric Field Attendant II	2	1/10/2001	Agric Field Attendant I	3	1/10/2008
61.	Alabi, M.	Agric Field Attendant II	2	1/10/2001	Agric Field Attendant I	3	1/10/2008
62.	Adebisi, Y.	Agric Field Attendant II	2	1/10/2001	Agric Field Attendant I	3	1/10/2008
63.	Ojo, Mukaila	Agric Field Attendant II	2	1/10/2001	Agric Field Attendant I	3	1/10/2008
64.	Adewumi, A. (Mrs.)	Agric Field Attendant II	2	1/10/2001	Agric Field Attendant I	3	1/10/2008
65.	Anikudi, F. (Mrs.)	Agric Field Attendant II	2	1/10/2001	Agric Field Attendant I	3	1/10/2008
66.	Oladipo, J.	Agric Field Attendant II	2	1/10/2002	Agric Field Attendant I	3	1/10/2008
67.	Akele, O.	Agric Field Attendant II	2	1/10/2002	Agric Field Attendant I	3	1/10/2008
68.	Olawore B. (Mrs.)	Agric Field Attendant II	2	1/10/2001	Agric Field Attendant I	3	1/10/2008
69.	Olagunju N.	Agric Field Attendant II	2	1/10/2002	Agric Field Attendant I	3	1/10/2008
70.	Moses O.	Agric Field Attendant II	2	1/10/2002	Agric Field Attendant I	3	1/10/2008
71	Akinwale, O	Agric Field Attendant II	2	1/10/2002	Agric Field Attendant I	3	1/10/2008
73.	Amusa, L.	Agric Field Attendant II	2	1/10/2002	Agric Field Attendant I	3	1/10/2008
74.	Igwe, F. I.	Agric Field Attendant II	2	1/10/2002	Agric Field Attendant I	3	1/10/2008
75.	Akinola, A. A. (Mrs.)	Agric Field Attendant II	2	1/10/2003	Agric Field Attendant I	3	1/10/2008
76.	Toiki Ojo	Agric Field Attendant II	2	1/10/2003	Agric Field Attendant I	3	1/10/2008

77	Thomas James	Agric Field Attendant II	2	1/10/2003	Agric Field Attendant I	3	1/10/2008
78.	Adeleke A. A.	Agric Field Attendant II	2	1/10/2003	Agric Field Attendant I	3	1/10/2008
79.	Okpaise I. (Mrs.)	Agric Field Attendant II	2	1/10/2003	Agric Field Attendant I	3	1/10/2008
80.	Musa A.	Agric Field Attendant II	2	1/10/2003	Agric Field Attendant I	3	1/10/2008
81.	Unubi, A.	Agric Field Attendant II	2	1/10/2003	Agric Field Attendant I	3	1/10/2008
82.	Opalua P.	Agric Field Attendant II	2	1/10/2003	Agric Field Attendant I	3	1/10/2000
83.	Davide, A.	Agric Field Attendant II	2	1/10/2003	Agric Field Attendant I	3	1/10/2008
84.	Ignatius, A.	Agric Field Attendant II	2	1/10/2003	Agric Field Attendant I	3	1/10/2008
85.	Domi M. (Mrs.)	Agric Field Attendant II	2	1/10/2003	Agric Field Attendant I	3	1/10/2008
86.	Ganiyu O.	Agric Field Attendant II	2	1/10/2003	Agric Field Attendant I		1/10/2008
87.	Oguntade G.	Clerical Officer I	4	1/10/2006	Agric Field Attendant I	5	1/10/2008
88.	Obi, E. (Mrs.)	Clerical Officer II	3	1/10/2005	Agric Field Attendant I	4	1/10/2008
89.	Adeleke, S. O.	Clerical Officer II	3	1/10/2005	Agric Field Attendant I	4	1/10/2008
90.	Ihejirika G.E.	Clerical Officer Il	3	1/10/2006	Agric Field Attendant I	4	1/10/2008
91.	Atanda, C. O. (Miss.)	Clerical Officer II	3	1/10/2006	Agric Field Attendant I	4	1/10/2008
92.	Olutade A. O. (Mrs.)	Clerical Officer II	3	1/10/2006	Clerical Officer I	4	1/10/2008
93.	Oguntoyinbo W.	Clerical Officer II	4	24/4/07	Clerical Officer I	5	1/10/2008
94.	Oghenegueke R. J. (Mrs.)	Asst. Clerical Officer	2	1/1/2006	Clerical Officer II	3	1/10/2008
95.	Ogunleye, B. O. (Mrs.)	Asst. Clerical Officer	2	1/1/2006	Clerical Officer II	3	1/10/2008
96.	Abas, S. T.	Asst. Clerical Officer	2	1/1/2006	Clerical Officer II	3	1/10/2008
97.	Ogbechie, B. M. (Mrs.)	Asst. Clerical Officer	2	1/1/2006	Clerical Officer II	3	1/10/2008
98.	Kuforiji B. M. (Mrs.)	Asst. Clerical Officer	2	1/1/2006	Clerical Officer II	3	1/10/2008
99.	Rafiu A. O. (Mrs.)	Asst. Clerical Officer	2	1/1/2006	Clerical Officer II	3	1/10/2008
100.	Joda E. M. (Mrs.)	Asst. Clerical Officer	2	1/1/2006	Clerical Officer II	3	1/10/2008
101.	Ganiyu B.R. (Mrs.)	Asst. Clerical Officer	2	1/1/2006	Clerical Officer II	3	1/10/2008
102.	Akinrinola A. K.	Asst. Clerical Officer	2	1/1/2006	Clerical Officer II	3	1/10/2008
103.	Bakare M.A. (Mrs.)	Asst. Clerical Officer	2	1/1/2006	Clerical Officer II	3	1/10/2008

104.	Akinlade A.	Asst. Clerical Officer	2	1/1/2006	Clerical Officer II	3	1/10/2008
105.	Ali, S. O.	Asst. Clerical Officer	2	1/1/2006	Clerical Officer II	3	1/10/2008
106.	Olajumoke O. (Mrs.)	Asst. Clerical Officer	2	1/1/2006	Clerical Officer II	3	1/10/2008
107.	Nwajei M. (Mrs.)	Head Health Attd.	3	1/10/2004	Higher Health Assistant	4	1/10/2008
108.	Huseini Usman	Higher Health Assistant	4	1/10/2006	Snr. Health Assistant	5	1/10/2008
109.	Echi E. N. (Mrs.)	Higher Health Assistant	4	1/10/2006	Snr. Health Assistant	5	1/10/2008
110.	Emaku E. B. (Mrs.)	Higher Health Assistant	4	1/10/2006	Snr. Health Assistant	5	1/10/2008
111.	Iruobe E. (Mrs.)	Snr. Health Attendant	2	1/10/2006	Health Assistant	3	1/10/2008
112.	Rabiu S. T. (Mrs.)	Snr. Health Attendant	2	1/10/2006	Health Assistant	3	1/10/2008
113.	Williams H.E. (Mrs.)	Snr. Health Attendant	4	1/10/2006	Snr. Catering Assistant I.	5	1/10/2008
114.	Adepoju O. M. (Mrs.)	Head Steward	2	1/10/2006	Catering Assistant	3	1/10/2008
115.	Lasisi I.	Snr. Security Guard	4	1/10/2005	Head Security Guard	5	1/10/2008
116.	Egbuta D.	Security Guard Gd. I	3	1/10/2006	Snr. Security Guard	4	1/10/2008
117.	Ajulo F.	Security Guard Gd. I	3	1/10/2005	Snr. Security Guard	4	1/10/2008
118.	Ogbechie M.B.	Security Guard Gd. I	3	1/10/2006	Snr. Security Guard	4	1/10/2008
119.	Oloyede, A. S.	Security Guard Gd. I	3	1/10/2005	Snr. Security Guard	4	1/10/2008
120.	Salami M.	Security Guard Gd. I	3	1/10/2006	Snr. Security Guard	4	1/10/2008
121.	Babalola J. M. (Mrs.)	Security Guard Gd. I	3	1/10/2005	Snr. Security Guard	4	1/10/2008
122.	Babayemi K. A.	Security Guard Gd. I	3	1/10/2006	Snr. Security Guard	4	1/10/2008
123.	Fajutu O. S.	Security Guard Gd. I	3	1/10/2005	Snr. Security Guard	4	1/10/2008
124.	Olatunbosun H.	Security Guard Gd. I	3	1/10/2006	Snr. Security Guard	4	1/10/2008
125.	Nwaolise A. A.	Security Guard Gd. I	3	1/10/2006	Snr. Security Guard	4	1/10/2008
126.	Adeyemo A. R.	Security Guard Gd. I	3	1/10/2006	Snr. Security Guard	4	1/10/2008
127.	Omogbehin A. K. (Mrs.)	Security Guard Gd. I	3	1/10/2006	Snr. Security Guard	4	1/10/2008
128.	Ayoade G. A.	Security Guard Gd. I	3	1/10/2006	Snr. Security Guard	4	1/10/2008
129.	Adewumi L. O.	Security Guard Gd. I	3	1/10/2006	Snr. Security Guard	4	1/10/2008
130.	Babalola J. O.	Security Guard Gd. I	3	1/10/2006	Snr. Security Guard	4	1/10/2008
131.	Adeogun M. A.	Security Guard Gd. I	3	1/10/2006	Snr. Security	4	1/10/2008

					Guard		
132.	Bakare R. A.	Security Guard Gd. I	3	1/10/2006	Snr. Security Guard	4	1/10/2008
133.	Quadry B. A.	Security Guard Gd. I	3	1/10/2006	Snr. Security Guard	4	1/10/2008
134.	Oladejo A.	Security Guard Gd. I	3	1/10/2006	Snr. Security Guard	4	1/10/2008
135.	Lasisi G.	Head Watchman	3	1/10/2006	Snr. Security Guard	4	1/10/2008
136.	Adeyemo S. A.	Security Guard Gd. II	2	1/1/2005	Security Guard I	3	1/10/2008
137.	Omitade O. O.	Security Guard Gd. II	2	1/10/2005	Security Guard I	3	1/10/2008
138.	Adeleye K. R. (Miss)	Security Guard Gd. II	2	1/10/2006	Security Guard I	3	1/10/2008
139	Taiwo A. B.	Security Guard Gd. II	2	1/10/2006	Security Guard I	3	1/10/2008
140.	Ikpefua A. E.	Security Guard Gd. II	2	1/10/2006	Security Guard I	3	1/10/2008
141.	Bello S. A.	Security Guard Gd. II	2	24/4/07	Security Guard I	3	1/10/2008
142.	Akinji A. A.	Security Guard Gd. II	2	1/1/2006	Security Guard I	3	1/10/2008
143.	Njagwali S.	Security Guard Gd. II	2	1/10/2006	Security Guard I	3	1/10/2008
144.	Okonchie J.	Security Guard Gd. II	2	1/10/2006	Security Guard I	3	1/10/2008
145.	Owasi O.	Security Guard Gd. II	2	1/10/2006	Security Guard I	3	1/10/2008
146.	Ehisonomen J.	Security Guard Gd. II	2	1/10/2006	Security Guard I	3	1/10/2008
147.	Nuki J.	Security Guard Gd. II	2	1/10/2006	Security Guard I	3	1/10/2008
148.	Togun B.O. (Mrs.)	Snr. Craftsman	4	1/10/2006	Foreman	5	1/10/2008
149.	Oyeniran S.	Snr. Craftsman	4	1/10/2006	Foreman	5	1/10/2008
150.	Adeogun M.A.	Snr. Craftsman	4	1/10/2006	Foreman	5	1/10/2008
151.	Oladiti S.	Snr. Craftsman	4	1/10/2006	Foreman	5	1/10/2008
152.	Ironua S.	Snr. Craftsman	4	1/10/2006	Foreman	5	1/10/2008
153.	Uwaifor A.	Snr. Craftsman	4	1/10/2006	Foreman	5	1/10/2008
154.	Ibiyemi O. A.	Snr. Craftsman	4	1/10/2006	Foreman	5	1/10/2008
155.	Ojo L. I.	Snr. Craftsman	4	6/1/2006	Foreman	5	1/10/2008
156.	Adekanbi A.	Asst. Craftsman	2	1/10/2006	Craftsman	5	1/10/2008
157.	Adesida A.	Asst. Craftsman	2	1/10/2006	Craftsman	3	1/10/2008
158.	Oyawale M.	Asst. Craftsman	2	1/10/2006	Craftsman	3	1/10/2008
159.	Adeboye K.	Asst. Craftsman	2	1/10/2006	Craftsman	3	1/10/2008
160.	Okoi J.	Asst. Craftsman	2	1/10/2006	Craftsman	3	1/10/2008
161.	Eno I. E.	Store Keeper	3	1/10/2006	Snr. Store Keeper	4	1/10/2008
162.	Ajiroba A. T.	Snr. Motor Driver/Mech II	4	1/10/2006	Snr. Motor Driver/Mech I	5	1/10/2008
163.	Musa O. S.	Snr. Motor Driver/Mech II	4	1/10/2005	Snr. Motor Driver/Mech I	5	1/10/2008
164.	Kpeleye F.	Motor Driver/Mech	3	1/10/2006	Snr. Motor Driver/Mech	4	1/10/2008

					II		
165.	Odeku F.	Motor Driver/Mech	3/7	1/10/2005	Snr. Motor Driver/Mech II	4	1/10/2008
166.	Oyebanjo A. O.	Messanger	01	6/1/2006	Asst. Clerical Officer	2	1/10/2008

COCOA PROGRAMME

Experimental Title: Screening of some selected tree species for possible allelophatic effects in cocoa agroforestry. (Oloyede, A.A, Adejobi, K.O, Famaye,A.O, Fademi,O.A , Keji Dada and Iremiren, G.O)

Objectives: To evaluate the potential of some selected forest trees species for their suitability for cocoa agroforestry.

Methodology: Leaf and bark of *Tetrapluera tetraptera(TT),CedrellaodorataCDR),Triploc hyton, Schleroxylon(TRP), Albizia zygia(AZ)* were collected from Zone 5 of CRIN. The leaves and bark collected were air dried and milled using mortal and pestle four kilograms (4kg) of the materials were soaked in sterile water according to the method of Adeorike (2003) for 48 hours. The leachates were then sieved out and used to water the sown cocoa beans and the resulting seedlings. Four cocoa beans were sown per 7.5kg capacity in plastic buckets, perforated at the bottom, already filled with top soil collected under the various tree species to simulate the field soil condition. The pots were thereafter arranged in Completely Randomized Design (CRD). There were nine treatments of leaves and barks of four tree species and the control (CTR) with ordinary water. Data on germination, radical length, plumule length were taken at 14 and 28 days after sowing (DAS). Morphological parameters of height, stem diameter, number of leaves were collected one month after sowing.

Result and Discussion: Results on germination (%), radicule length, morphological parameters 30 DAS are presented in Tables 1,2 and 3. Results obtained so far showed that there were no significant negative effects of the leachates of the leaf and bark of the various tree species on cocoa germination, radicule and plumule lengths compared with the control (no leachate)-in fact the parameter were better than the control(Tables 1 and 2). There was no specific trend yet on growth parameters except that height was better in TRP bark (20.5cm) and CDR and TT leaves (22cm and 20.4cm). Stem diameter tend to be better under TT and TRP for leaf and bark (0.48cm, 0.38cm and 0.43cm, 0.38cm respectively). Number of leaves of 5.6, 5.0, 5.0 (leaf leachates of TT, CDR and AZ) is indicative of their suitability with cocoa, the bark leachates tend to follow similar trend. Bark leachates of various species tend to reduce cocoa leaf area except for TRP that was better than the control (CTR).

Conclusion: The work is, however, ongoing, final and definitive deduction shall be made at the end of the experiment.

Table 1: Mean percentage germination of cocoa as influenced by tree species

Treatments	14 DAS (%)		28 DAS (%)	
	Leaf	Bark	Leaf	Bark
TT	62.5	62.5	66.7	75.0
CDR	70.83	75.0	91.7	83.3
TRP	58.3	66.6	58.3	83.3
AZ	54.2	87.5	62.5	83.3
CTR	54.2	58.3	58.3	75.0

Table2: Mean ridicule and plumule length 14 and28 Days after Sowing

Treatments	Radicle length(cm) 14 DAS		Plumule length(cm) 14 DAS	
	Leaf	bark	Leaf	Bark
TT	7.7	6.1	10.6	10.9
CDR	12.5	7.1	11.4	11.5
TRP	6.2	9.9	7.4	12.1
AZ	9.3	7.8	12.3	7.3
CTR	6.2	6.2	9.6	9.6

Table 3: Mean growth parameters (height, stem diameter, number of leaves and leaf area DAS

Treatments	Height(cm)		Stem diameter(cm)		Number of leaves		Leaf area(cm^2)	
	Leaf	Bark	Leaf	Bark	Leaf	Bark	Leaf	Bark
TT	20.4	18.7	0.48	0.43	5.6	5.1	14.9	15.0
CDR	22.0	19.9	0.34	0.34	5.0	4.8	15.8	14.0
TRP	18.3	20.5	0.38	0.38	4.6	4.5	15.3	20.6
AZ	18.7	19.4	0.35	0.35	5.0	5.8	14.6	13.7
CTR	20.3	20.5	0.35	0.35	4.8	4.8	18.1	18.1

Experimental Title: Heavy metals contamination in fungicide treated cocoa plantations in Cross River State, Nigeria. (Aikpokpodion Paul)

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Introduction

Agriculture in Nigeria economy has contributed immensely to rural development, Industrial material, food security and non- oil foreign exchange earnings. Nigeria is currently the fourth largest producer of Cocoa (*Theobroma cacao*) with 190 metric tones in 2008. Cocoa is a crop of economic importance with more than 650,000 ha being cultivated in Nigeria (Sanusi and Oluyole, 2005). It ranked first amongst agricultural export crops in its contribution to foreign earnings (Tijani *et. al*, 2001). General and localized study have identified that the greatest factor responsible for the dwindling of cocoa production level in Nigeria is the ravages caused by black pod disease caused by *Phytophthora palmivora* and *P. megakarya*.

The major economic loss is from the infection of the pods which in turn affect the quality of the beans within the pods. Nigerian cocoa farmers make use of copper based fungicide which is believed to be the fastest and most reliable means of arresting the situation. The incidence of black pod disease is an annual occurrence and the degree of prevalence depends on the rate of precipitation and humidity. This naturally calls for annual application of copper based fungicides if the farmers must make bumper harvest of cocoa pods at the end of the year. In other words, an average Nigerian cocoa farmer applies Cu-based fungicide at least eight times in a year. The implication of this act is the accumulation of copper which is a heavy metal in the soil. Pollution of the natural environment by heavy metals is a worldwide problem because these metals are indestructible and most of them have toxic effects on living organisms (Dalman et al, 2006). Heavy metals are of high ecological

significance since they are not removed from soil as a result of self purification, but accumulate in reservoirs and enter the food chain (Loska & Wiechula, 2003).

There is increase awareness that heavy metals, present in soil, may have negative consequences on human health and on the environment (Abraham, 2002; Selinus *et al.*, 2005). From the environmental point of view, all heavy metals are largely immobile in the soil system, so they tend to accumulate and persist in agricultural soils for a long time. The most frequently reported heavy metals with regards to potential hazards and the occurrence in contaminated soils are Cd, Cr, Pb, Zn, and Cu (Alloway, 1995). The concentration of these toxic elements in soils may be derived from various sources including anthropogenic pollution, weathering of natural high background rocks and metal deposits (Senesi et al, 1999). At present, relatively little data are available on the extent of environmental pollution as a consequence of heavy metal- based fungicides used on Cocoa.

The study area covered the major cocoa producing areas of Ondo State which is the highest cocoa producing state in Nigeria. Most of cocoa farmers within this state use copper based fungicide for the control of black pod disease. Therefore, high levels of heavy metals might have been released into the soil environment as a result of the long term application of fungicides. It is, therefore, necessary to carry out an assessment of heavy metals contamination levels in soils under cocoa plantations in these major cocoa producing areas, because heavy metals, which are potentially harmful to human health, persists for a long time. In addition, the study will provide baseline information on the anthropogenic impact of environmental pollution from heavy metals on cocoa plantation more so, that these metals can be hazardous when they enter into food chain in a high concentration that can be toxic to man and animals.

Objective: To determine the heavy metal pollution status of Cocoa plantations in Cross River State

Materials and Methods

The soil samples were collected from Boki-biakwan, Yahunde,Okundi, Bendege, Efraya, Grassfield Efraya 3-corner and Efraya strabag The sampling sites were selected in order to cover the major cocoa producing areas in Cross River State. Most of the cocoa farms in the state were less than thirty years in age. Soils samples were taken with soil auger at a depth of 0-30cm. Twenty five (25) samples were collected in a hectare and composite samples were made from the individual soil samples. Control (background) soil samples were collected from uncultivated adjacent forests to the cocoa farms. The soil samples were air dried and sieved with a 2mm sieve.

Portion of samples were leached with 1N ammonium acetate. The leachate was analyzed for exchangeable cations (Ca^{2+}, Mg^{2+}, K^{+} and Na^{+}) determination (Schollenberger and Simon, 1945, Sharman *et al.*, 1942). Soils were analyzed for particle size by the Boyocous hydrometer method soil pH was measured with glass electrodes in 1:2.5 soil-water suspensions. The organic carbon was determined using Walkley and Black method (1934). Total Nitrogen was determined by the Macro Kjedahl method (Jackson *et al*.,1986)). Available Phosphorus was determined using Bray and Kurtz (1945). Another portion (1g) of the soil sample for heavy metal analysis was extracted with 10ml of 0.1N HCl. The extracts were analyzed for Cu, Pb, Zn, Cd and Fe using air/acetylene atomic absorption spectrophotometer (Unican 929 Model).

Anthropogenic Contamination Factor (CF) and degree of Contamination (Cdeg): These are quantification of the degree of contamination as single-metal index (CF) and as overall degree of contamination (C deg). The measure is relative to either average

crustal composition of the respective metal or to a measured background values from a geologically pristine/ uncontaminated area.

Enrichment Factor

The use of the enrichment factor (EF) for the assessment of soil contamination with metals has been suggested by Beat – Merond 1979. An element is regarded a reference element if it is of low occurrence and is present in the environment in trace amounts. It is also possible to apply an element of geochemical nature whose substantial amounts occur in the environmental but has no characteristic effects. i.e. synergism or antagonism towards an examined element. The most common reference elements are Sc, Mn, Al and Fe (Loska et al, 1997). Despite certain shortcomings (Rein mann and Caritat, 2000) the enrichment factor, due to its universal formula, is a relatively simple and easy tool for assessing enrichment degree and comparing the contamination of different environmental media.

Index of geoaccumulation (I_{geo}) as proposed by Mueller, 1979 has also been widely used to evaluate the degree of metal contamination in terrestrial, aquatic as well as marine environments (Sutherland, 2000; Sahu and Bhosale, 1991; Singh et al, 1997). It is expressed as:

$$\mathbf{I_{geo}} = \mathbf{log_2} \frac{Cn}{1.5\,Bn}$$

Where C_n is the measured concentration of the element n in the soil and B_n is the geochemical background value of element n in the background or control within the study area. The constant 1.5 is a factor which allows us to analyze natural fluctuations in the content of a given substance in the environment and very small anthropogenic influences.

Pollution load index (PLI)

Pollution load index for a particular site, has been evaluated following the method proposed by Tomilson et al, (1980). This parameter is expressed as

$$PLI = (CF_1 \times CF_2 \times CF_3 \ldots\ldots\ldots\ldots CF_n)^{1/n}$$

Where n is the number of metals and CF is the contamination factor. The contamination factor can be calculated from the following relation

$$\mathbf{CF} = \frac{Metal\ concentration\ in\ soil}{Background\ value\ of\ the\ metal}$$

Results and discussion

Result of the enrichment factor of Cu, Pb, Zn and Cd in the studied coca plantations is presented in table 1. Result showed that, the EF of Cu ranged from 2.55-5.77 with a mean value of 4.03. According to the contamination categories established by Loska et al., (1997). The studied cocoa plantations have moderate enrichment to significant enrichment. This is higher than Loska et al, 2004. The youngest of all the cocoa farms studied had the lowest Cu enrichment factor. This suggests that, the age of cocoa plantation could be a factor contributing to copper contamination of cocoa plantation soils.The EF of Pb, which ranged from 0.77-3.07 with an average value of 1.35. It showed that the enrichment of Pb in the studied cocoa is depletion to moderately enrich. It then infers that the soils are not contaminated with Pb rather, the content of lead in the soil is from parent materials and not as a result of anthropogenic activity (Table1).

Table 1: Enrichment factor of heavy metals in cocoa soils

Farm	Cu	Zn	Pb	Cd
Grassfiel 1	4.3	3.17	1.09	0.98
Grassfiel 2	4.29	2.05	0.96	0.89
Efraya 1	4.38	3.68	1.02	0.87
Yahunde	3.27	2.53	1.06	0.94
Efraya2	3.96	2.16	0.77	0.93
Boki bia 1	5.77	2.36	1.48	1.01
Boki biak2	3.3	1.15	1.21	0.87
Okundi 1	4.78	2.11	2.12	0.76
Boki biak3	3.34	2.7	1.2	0.95
Bendege	4.97	3.99	3.07	0.94
Efraya strab	3.41	2.55	1	1.03
Okundi 2	2.55	1.45	1.23	0.97
Min	2.55	1.15	0.77	0.76
Max	5.77	3.99	3.07	1.03
Mean	4.03	2.49	1.35	0.93

The EF of Zn in the studied area ranged from 1.15-3.99 with a mean value of 2.49. The EF category according to Loska *et al.*, 1997 showed that Zn enrichment in the studied areas ranged from depletion to moderate enrichment, while the Cd enrichment factor ranged from 0.76-1.03 with an average value of 0.93 (Table 1) . Hence, Cd enrichment ranged from depletion to minimal.

Geoaccumulation index

Result of the geoaccumulation index (I_{geo}) is presented in Table 2. Geoaccumulation index of Cu ranged from 0.77 – 2 with a mean value of 1.46. Based on the categorization of Loska et al, (1997), the studied soils ranged from moderately contamination to heavily contamination level. This I_{geo} mean value is higher than the value reported by Loska et al., (2004) which was negative in farming soil in Poland. The intake of Cu by plants is proportional to the content of its soluble forms in soil which increases at low pH (Kabata-pendias and Pendias, 1999). Moreover, Copper compounds from anthropogenic sources are more available to plants than the ones from natural sources.

Table 2: Geoaccumulation index of heavy metals in cocoa soils

Farm	Cu	Zn	Pb	Cd
Grassfiel1	1.48	1.04	-0.49	-0.66
Grassfiel2	1.53	0.47	-0.62	-0.73
Efraya 1	1.57	1.32	-0.53	-0.58
Yahunde	1.11	0.74	-0.51	-0.51
Efraya2	1.37	0.5	-1	-0.48
Boki bia 1	2	0.71	0.03	-0.52
Boki biak2	1.94	-0.06	-0.32	-0.61
Okundi 1	1.67	0.51	-0.49	-0.65
Boki biak3	1.11	0.8	-0.29	-0.49
Bendege	1.74	2.17	-0.59	-0.62
Efraya strab	1.23	0.8	-0.49	-0.64
Okundi 2	0.77	-0.06	-0.3	-0.47
Min	**0.77**	**-0.06**	**-1**	**-0.73**
Max	**2**	**2.17**	**0.03**	**-0.47**
Mean	**1.46**	**0.75**	**-0.47**	**-0.58**

I_{geo} for Pb in the studied soils ranged from – 1 to 0.03 with a mean value of – 0.47. The I_{geo} being negative showed that the cocoa soils studied are practically uncontaminated with Pb. This implies that, the Pb content of the soils is not from anthropogenic sources rather it is from natural source. The range is lower than that reported by Loska et al., (2004) -2.2 to 0.7 in Poland agricultural soil. The geoaccumulation index of Zinc ranged from -0.06 to 2.17 with a mean value of 0.75. I_{geo} result showed that the range of Zn contamination is from uncontaminated to moderately contaminate according to Muller, 1981 classification. By the classification of Muller, 1981 and Loska et al., 1997, the soils studied were practically uncontaminated with cadmium. The Cd content of the soils ranged from -0.73—0.47. It then infers that the Cd in cocoa plantations examined in this work is solely from natural source.

Contamination Factor

Result of CF of the studied soils is presented in table 3. Contamination factor of copper ranged between 2.55 and 6 with a mean factor

of 4.04. Contamination factor of Pb ranged from 0.76 to 3.1 with a mean factor of 1.36 while the contamination factor of Zn ranged from 1.14 to 4.03 with an average value of 2.5 and the contamination factor of Cd ranged from 0.76 to 1.03 with a mean of 0.96. According to the CF classification of Hakanson (1980), the soils studies were minimally to moderately contaminate with Pb, Zn and Cd. The I_{geo} mean values of these three heavy metals are lower than the I_{geo} mean value (2.8) reported by Loska et al; 2004.

Table 3: Contamination factor of heavy metals in cocoa soils

Farm	Cu	Zn	Pb	Cd
Grassfield1	4.21	3.11	1.07	0.99
Grassfield2	4.34	2.07	0.97	1.01
Efraya 1	4.47	3.75	1.04	0.98
yahunde	3.24	2.5	1.05	1.02
Efraya2	3.88	2.12	0.76	1.01
Boki bia 1	6	2.45	1.54	0.87
Boki biak2	3.27	1.14	1.2	0.76
Okundi 1	4.78	2.11	2.12	0.97
Boki biak3	3.24	2.62	1.16	1.03
Bendege	5.02	4.03	3.1	0.97
Efraya strab	3.51	2.63	1.03	0.87
Okundi 2	2.55	1.45	1.23	1.02
Min	**2.55**	**1.14**	**0.76**	**0.76**
Max	**6**	**4.03**	**3.1**	**1.03**
Mean	**4.04**	**2.5**	**1.36**	**0.96**

MCI (Metal Contamination Index)

Result of Metal Contamination Index is presented in fig 1. It ranged from 2 to 9.6. According to Meybeck et al; 2004 classification of MCI, the studied soils ranged from very low contamination to high contamination. Result of contamination factor (Table) showed that, Cu contamination is responsible for the high contamination of the entire studied area. The contribution of Pb, Zn and Cd is minimal to the overall contamination of the soils.

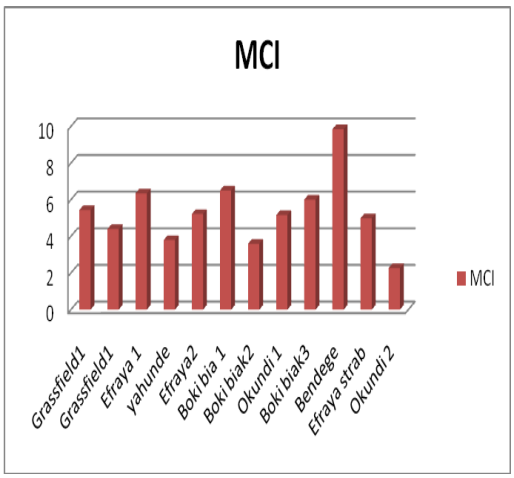

Figure 1: Metal contamination index in fungicide treated cocoa soils

Pollution load index

Result of Pollution load index (PLI) which is the nth root of the multiplication of all the contamination factors for all the examined heavy metals is presented in fig 2.

According to Tomlinson et al, (1980), (0.0) indicates perfection, a value of one (1.0) indicates only baseline levels of pollutant present and values above one (> 1.00) would indicate progressive deterioration of the site. PLI values of the studied cocoa plantation soil ranged from 1.5 to 3.9. Result confirmed that the studied cocoa farms are polluted. The PLI can provide some understanding to the cocoa farmers in Ondo State and all the cocoa growing states in Nigeria at large who use copper based fungicide in combating the menace of black pod disease about the quality of agricultural soils which is component of their environment.

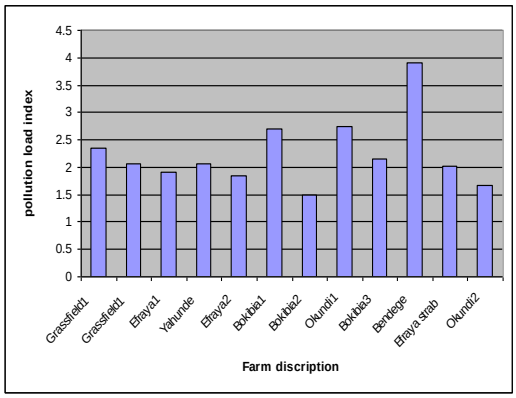

Figure 2: Pollution load index of heavy metals in fungicide treated cocoa soils

In addition, it also provides valuable information and advice for the policy and decision makers on the pollution level of cocoa soil in Ondo State and the entire nation at large.

Conclusion

The results of the various environmental factors used (enrichment factor, geoaccumulation index, contamination factor, metal contamination index and pollution index) showed that all the cocoa plantations studied were polluted with heavy metals. Results also showed that the overall pollution is mainly due to the presence of copper in the soil as a consequence of cu-based fungicide application by farmers during black pod disease control. However, the PLI values confirmed that the quality of the cocoa soils studied is deteriorating and this may have severe impact on soil biodiversity and ground water.

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Experimental Title: Determinants of the occurrence of black pod disease of cocoa in Edo State, Nigeria: a multivariate probit analysis approach (Oluyole K.A.and. Lawal J. O)

Introduction

Nigeria as a developing country was rated the second largest world producer of cocoa in the 1960's (Adegbola and Abe, 1983), and for a long time the crop has been generating substantial foreign exchange earnings for the country. However, the production of this important cash crop for export suffered a reduction in recent years in the country owing to a number of factors. Villalobos (1989) identified some of these factors as low yield, ageing of trees, inconsistent production pattern, use of simple farm tools and of course disease and pest attack. Anonymous(1979) reiterated the main problem confronting cocoa production in Nigeria as very low yield due to attacks of pests and disease which are capable of destroying more than half of the little production. Many diseases affect cocoa on the field. Some of them are Phytophthora Black pod disease, Phytophthora canker, phytophthora seedling blight, Thielaviopsis pod rot, *Cocoa swollen shoot virus (CSSV)* disease, Cherelle wilt, Charcoal pod rot and Collar crack disease (Adegbola, 1972). But those of economic importance in Nigeria are three: Black pod disease, Swollen shoot virus and Cherelle wilt (Opeke, 1987). In economic terms, black pod disease is the most serious disease of cocoa in Nigeria. It is caused by a soil-borne fungus, *Phytophthora palmivora* and is prevalent only during the wet season. The disease is therefore worse in areas of heavy rainfall. Major damage from the disease is the rotting of both small and large pods. Coupons, seedlings (in the nursery) and leaves of trees are attached and killed under specially severe disease conditions following long periods of cool and rainy weather. Losses due to black pod disease vary from place to place and from variety to variety. Adegbola (1972) put the average at about 40 percent over several parts of West Africa and up to 90 percent in certain places in Nigeria. Deduction from analysis of data from the Cocoa Research Institute of Nigeria (CRIN) indicates that pod loss due to black pod disease infection varies with variety of cocoa. The average percent pod loss over the years 1962-1993 was 7.56 for Amazon I, 6.56 for Amazon II, 7.01 for Amazon III and 13.03 for Amelonado (Tijani, 2005). Babcock *et al* (1992) noted that those yield losses could be reduced through the use of chemical control agents (synthetic pesticides) have been favoured because of their effectiveness (although in many cases, this diminishes with time), their relative shelf life (when properly stored), and the ease with which they can be transported, stored and applied. Eguagie (1974) and Idachaba and Olayide (1976) have indicated a possible loss in yields of between 50% and 70% in cocoa production if no chemical measures were applied. It should however be noted that much money is being spent on the procurement of these chemicals thus draining the income of the farmers.

Objective: This study aims to determine the factors that favour the spread of black pod disease in the study area.

Methodology

The study was carried out in Edo state, which is in the southern part of Nigeria and is one of the cocoa producing states in the country. By National Cocoa Development Committee (NCDC) rating, Edo state is a medium cocoa producing state in the country. A simple random sampling of fifty respondents was carried out in seven Local Government Areas (LGAs) in the state. The LGAs were Ovia North East, Ovia South, Esan West, Owan West, Owan East, Etsako West and Akoko Edo. The respondents were interviewed with the use of well-structured questionnaire. The questionnaire was structured to elicit information on socio-economic and demographic characteristics of the respondents. Prevalence of black pod disease

in their farms and the control measures on black pod disease in their farms. The data collected were analysed using probit model which is a regression technique that is used with categorical dependent variables. It is most commonly used with binary dependent variables that can assume only the values 0 or 1, such as the occurrence of a specific event. The independent variable may be either continuous or binary. The parameters of a probit model are estimated by maximum likelihood estimation rather than by Ordinary Least Square. The model can be stated as:

$Ci = \Theta Xi + \varepsilon i$

Where,

Ci =Variable that indexes the prevalence of black pod disease on farms (C=1 if there's presence of black pod disease on farm; C=0 if there's no black pod disease on farms).

Θ = Vector of unknown coefficients

Xi = Vector of explanatory variables

εi = Stochastic error term

The explanatory variables (Xi) included in the probit model are:

AVF = Availability of fungicides (Available =1, Not available = 0).

PRP = Price of spraying pump (N)

PRF = Price of fungicides (N)

EDL= Educational level of farmers (no formal education=0, primary education= 1, secondary = 2, tertiary = 3, adult education = 4).

CRA= Credit accessibility of the farmer (accessibility = 1, not accessibility = 0)

ASS = Farmers' membership of association (member =1, non-member =0)

PRC= Price of cocoa beans (N)

QPH= Quantity of cocoa pod husk on the farm (Ton)

LAB= Labor availability (available =1, not available = 0)

Results and Discussion

Probit analysis showed that the following variables significantly affected the occurrence of blackpod disease (Table1). Price of fungicides, significant at 5% level; Price of spraying pump, significant at 10% level; Educational level of farmers, significant at 10% level; Farmers' membership of association, significant at 5% level; Price of cocoa beans, significant at 10% level and Quantity of cocoa pod husk, significant at 10% level. However, availability of fund, credit accessibility of the farmers and labour availability did not affect the occurrence of blackpod disease significantly according to the probit analysis results.

Price of fungicide (PRF) was a significant determinant of the probability of a farm having black pod disease ($p<0.05$). This means that price of fungicides significantly influence the probability of the occurrence of black pod disease in cocoa farm in the study area. It could also be observed in Table 1 that Price of fungicides (PRF) positively influenced the probability of the occurrence of black pod disease. This however means that the higher the price of fungicides, the higher the probability of the occurrence of black pod disease. Price of spraying pump (PRP) was also a significant factor of the probability of the occurrence of black pod diseases meaning that price of spraying pump significantly determine the probability of the occurrence of black pod disease. Educational level of the farmers' (EDL) was a significant determinant ($p<0.1$) of the probability of the occurrence of blackpod disease on the farmers' farm (Table 1). This implies that educational level of the farmers has significant effect on the probability of the occurrence of blackpod disease. Educational level however negatively influenced the probability of the occurrence of blackpod disease. This means that the higher the educational level of the farmers, the lower the probability of the occurrence of blackpod disease. However, farmers' membership of association negatively influenced the probability of the occurrence of the disease. Meaning that the higher the involvement of a farmer in the association, the lower the occurrence of BPD. Price of cocoa beans (PCB) was a significant factor ($p<0.1$) of the

probability of the occurrence of BPD (Table 1). It could also be observed from the table that PCB negatively influenced the occurrence of BPD. Hence, the higher the PCB, the lower the probability of the occurrence of BPD. Quantity of cocoa pod husk on the farm (QPH) also significantly and positively influenced the probability of disease occurrence ($p<0.1$). This implies that QPH significantly determine the probability of the BPD on the farms. The negative influence means that the higher QPH, the higher the probability of the occurrence of blackpod disease on farms.

Table 1: Probit Result for determinants of black pod disease

Variables	Coefficient	Probability
Constant	0.5319	0.6805
AVF	1.7032	0.1457
PRF	0.0001**	0.0395
PRP	-0.0003*	0.0923
EDL	-0.5559*	0.0879
CRA	-5.8631	0.9999
ASS	-1.7155**	0.0225
PRC	-0.0132*	0.0822
QPH	0.0002*	0.0744
LAB	-0.2808	0.4393
Log likelihood -14.74932012		

** Significant at 5%, * significant at 10%
Source: Field survey, 2007

Conclusion

Findings of the study however revealed that prices of fungicide (chemicals for controlling blackpod disease of cocoa) as well as the price of spraying pump were significant factors in determining the probability of farm having black pod disease($p<0.05$ and $p<0.1$) respectively. The socio-economic and cultural factor of farmers such as educational level as well as membership of association were also found to be significant factor ($p<0.05$ and $p<0.1$) respectively. Also, prices of cocoa beans as well as the quantity of cocoa pod husk were found as determinants for the possibility of the occurrence of BPD. However, of all the factors investigated, availability of fungicides, credit accessibility as well as labour availability were found not to have significantly influenced the possibility of disease occurrence. It could therefore be concluded that the crucial determinants of the occurrence of BPD in cocoa farms in the study area are price of fungicides, price of spraying pump, educational level of the farmers, farmers' membership of association, price of cocoa beans and the quantity of cocoa pod husk on farms.

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Experimental Title: Evaluation of cocoa pod husk based organic, organomineral and NPK fertilizers on an old cocoa farm in Ikoromaja, Osun State **(**Ogunlade M.O, Aikpokpodion P.O, Oloyede,A.A, Oluyole K.A and Adeogun, S.O)

Introduction

Wessel (1971) reported steady decline in almost all the nutrients under cocoa plantation with length of cultivation. Omotoso (1975) showed that a crop of 1000kg dry cocoa beans removed about 20kg N, 4kg p and 10kg K and where the method of harvesting (as in Nigeria) involves the removal of pod husks from the field, the amount of K removed is increased more than five folds. Nutrients are being "mined" in cocoa farms through harvest without replacement in the form of fertilizer application. Cocoa soils in Nigeria are highly depleted in phosphorus (Ogunlade and Aikpokpodion, 2006). In spite of this cocoa soils nutrient depletion, more than 80% of cocoa farms in Nigeria do not use fertilizer on their farms Ogunlade *et. al* (2009). Sustaining soil fertility and increasing productivity can best be achieved through combination of both organic and inorganic fertilizers (Adetunji 2005). Hence, this work seeks to expose the farmers to the use of CPH based organic and organo-minerial fertilizers on selected cocoa plantations in Ikoromaja, Osun States with their active participation.

The objectives of this study, therefore, are to:

- develop organic and organomineral fertilizers from cocoa pod husks, neem leaves, chromolaena, urea and sokoto rock phosphate;
- evaluate the effects of the fertilizers on cocoa pod yield with active participation of farmers with the aim of introducing fertilizers to them.

Methodology

The study was carried out in Ikoromaja cocoa farming community, Osun state. This community was selected based on their previous working relationship with CRIN and

their interest to participate in the use of cocoa pod husk based fertilizer on their cocoa farms. The participating farmers (about 25) agreed and selected a farm where the study was carried out. Soil samples were collected, processed and analysed in the laboratory for their nutrient contents.The organic materials-CPH, neem leaves and *Chromolaena odoratum* were collected around the farmers's farm and processed. N, P and K contents of the organic materials were determined in the laboratory.

The selected cocoa farm was planted in 1969. It was divided into three blocks along the gentle slope. There were three fertilizer treatments (i) organic, (ii) organomineral (iii) NPK 20:10:10, plus a control without fertilizer application.

In each of the blocks, each treatment was administered on 4 cocoa trees.

Each of the fertilizer treatment was applied at the rate of 100kg N/ha. Organic fertilizer was formulated with 50kgN CPH, 25KgN Neem leaf and 25KgN Chromolaena. Organomineral fertilizer was formulated with 50kg N CPH and 50kN urea/hectare. Weeding was done weeks before fertilizer application. The fertilizer application was carried out in June 2009.

Results and Discussion

The soil pH of the selected site was 5.8 (Table1) which fell within the ideal pH range for cocoa. The available P and exchangeable K, Ca and Mg were below the critical values of 10mg/kg,0.3, 5.0 and 0.9cmol/kg soil respectively required by cocoa (Table 1).

Table1: Soil physical and chemical properties of the selected site before treatment application

Soil properties	Units	Values
pH	-	5.8
O.C	g/kg	13.5
N	g/kg	1.8
P	mg/kg	4.6
K	cmol/kg	0.15
Ca	cmolkg	2.42
Mg	coml lkg	0.56
Zn	mg/kg	6.25
Ca	mgl kg	8.81
Mn	mglkg	71.8
Fe	mg/lkg	64.5
Sand	g/kg	640
Silt	g/kg	160
Clay	g/kg	200

The nitrogen, phosphorus and potassium contents of the organic materials (Table 2) indicated similar nitrogen content for both neem leaf and chromolaena odorata.

Table 2: N, P and K contents of organic materials

Properties	Cocoa pod husk	Neem leaf	Chromolaena
N(g/kg)	10.8	25.9	25
P(g/kg)	1.2	1.7	7
K(g/kg)	39.6	25.0	43

All the fertilizer types significantly increased dry bean yield compared with control (Table3). Pod yield was highest (though not significantly) under NPK fertilizer treatment probably due to higher rate of nutrient release compared to other fertilizers.

Table 3: Effect of fertilizer on cocoa dry bean yield

Treatments	Mean cocoa dry bean yield(kg/ha)
CPH based organic fertilizer	810a
Organomineral fertilizer	960a
NPK	1030a
Control	650b

Conclusion

Significant cocoa dry bean yield increase under fertilizer treatments compared with control suggests the need for fertilizer application to nutrient depleted cocoa plantation to enhance yield.

Experimental Title: Influence of root mat removal and fertilizer types application on the establishment of cocoa in the field. **(**Ibiremo, O.S, Fademi, O.A, Iremiren and Oloyede, A.A)

Objective: To evaluate effect of root mat treatment and fertilizer application on the performance of cocoa in the early years of establishment.

Methodology: Six treatment combinations was formed from two levels of root mat treatments (with and without root mat) and three rates of NPK fertilizer application for experiment A. Experiment B consisted of six treatment combinations comprising two levels of root mat treatments (with and without root mat) and three types of phosphate fertilizer application. The root mat treatments was done during transplanting while the NPK fertilizer and phosphate fertilizer was applied a month after transplanting. The treatments was arranged in CRD with three replications. The height, stem diameter, number of leaves and leaf area of the transplanted cocoa seedlings were regularly taken.

Results: Seedlings with root mat not removed consistently enhanced the height of cocoa seedlings at 3, 6, 9, 12, and 15 MAT. Similarly, the stem diameter of cocoa seedlings at 3MAT was significantly improved as a result of non-removal of root mat. However, the influence of root mat removal on the stem diameter of cocoa seedlings was not consistently higher than those with root mat intact at 6 and 9 MAT it gave higher stem diameter at 12 and 15MAT. Root mat removal did not significantly affect the number of leaves and leaf area of the cocoa seedlings throughout the period of study. P-fertilizer application did not show significant effect on the height, stem diameter, number of leaves and leaf of cocoa seedlings throughout the period of study

Table 1: Influence of root mat removal and phosphate fertilizers on the performance of cocoa seedlings in the field.

	3MAP				6MAP			
Treatments	HT	SD	NL	LA	HT	SD	NL	LA
$MAT^{+}+P_0$	12.18^{a}	0.26^{b}	5.83^{a}	148.14^{a}	24.03^{a}	0.57^{a}	6.63^{a}	72.86^{a}
$MAT^{-}+P_0$	4.61^{b}	0.25^{b}	2.28^{a}	94.44^{a}	12.88^{b}	0.82^{a}	6.84^{a}	91.86^{a}
$MAT^{+}+P_1$	9.13^{a}	0.30^{ab}	4.48^{a}	110.93^{a}	21.36^{ab}	0.78^{a}	6.65^{a}	166.16^{a}
$MAT^{-}+P_1$	8.52^{a}	0.26^{b}	3.13a	88.53^{a}	14.50^{b}	0.52^{a}	6.88^{a}	94.11^{a}
$MAT^{+}+P_2$	10.43^{a}	0.38^{a}	4.95^{a}	132.76^{a}	20.67^{ab}	0.48^{a}	5.00^{a}	124.37^{a}
$MAT^{-}+P_2$	6.06^{ab}	0.25^{b}	6.36^{a}	60.49^{a}	15.07^{ab}	0.58^{a}	9.67^{a}	96.47^{a}

For each location means in columns followed by the same letter(s) are not significantly different by Duncan's Multiple Range Test at ($P < 0.05$).

	9MAP				12MAP			
Treatments	HT	SD	NL	LA	HT	SD	NL	LA
$MAT^{+}+P_0$	38.30^{a}	0.84^{a}	8.49^{a}	217.40^{a}	43.24^{a}	1.30^{ab}	13.4^{b}	170.07^{a}
$MAT^{-}+P_0$	23.56^{ab}	0.96^{a}	11.91^{a}	117.59^{a}	38.00^{a}	1.01^{b}	8.30^{b}	224.01^{a}
$MAT^{+}+P_1$	29.12^{ab}	0.87^{a}	13.08^{a}	190.03^{a}	35.97^{a}	1.31^{ab}	19.0^{b}	221.84^{a}
$MAT^{-}+P_1$	28.41^{ab}	0.91^{a}	11.40^{a}	163.80^{a}	32.25^{ab}	1.39^{a}	16.20^{b}	206.46^{a}
$MAT^{+}+P_2$	22.27^{b}	0.96^{a}	167.83^{a}	174.76^{a}	33.22^{b}	1.11^{ab}	285.6^{a}	199.46^{a}
$MAT^{-}+P_2$	31.00^{ab}	0.99^{a}	13.07^{a}	134.12^{a}	36.90^{a}	1.10^{b}	12.9^{b}	223.32^{a}

For each location means in columns followed by the same letter(s) are not significantly different by Duncan's Multiple Range Test at ($P < 0.05$).

	15MAP				18MAP			
Treatments	HT	SD	NL	LA				
$MAT^{+}+P_0$	65.81^{a}	1.67^{b}	31.93^{ab}	164.01^{a}				
$MAT^{-}+P_0$	48.80^{bc}	1.10^{b}	7.50^{b}	115.18^{a}				
$MAT^{+}+P_1$	61.30^{a}	1.68^{b}	26.30^{ab}	295.45^{a}				
$MAT^{-}+P_1$	38.30^{c}	2.87^{a}	22.40^{ab}	134.37^{a}				
$MAT^{+}+P_2$	65.67^{a}	1.37^{b}	30.55^{ab}	216.08^{a}				
$MAT^{-}+P_2$	60.10^{ab}	1.77^{b}	40.80^{a}	352.76^{a}				

For each location means in columns followed by the same letter(s) are not significantly different by Duncan's Multiple Range Test at ($P < 0.05$).

Conclusion: Root mat removal seemed not to impact positively on the growth of cocoa seedlings.

Experimental Title: Growth and early field establishment of cocoa (*Theobroma cacao*) as influenced by organic, inorganic and organomineral fertilizers. (C.I. Iloyanomon)

Introduction

Cocoa production has expanded beyond the conventional producing areas to areas which are considered marginal. This expansion coupled with unavailability of suitably fertile soil has made cocoa production dependant on already exploited soil.

Nitrogen and phosphorous are the most limiting nutrients in cocoa production, and most arable lands in the tropics are deficient in N and P (Kummer, 1988). Inorganic fertilizer has been successfully used to supply nutrients to cocoa, however, fertilizer use per hectare in Nigeria is low when compared with world average. This has been attributed to high cost of fertilizers, poor distribution network, government policies among other reasons. This, coupled with the detrimental effect of continuous use of inorganic fertilizer, has made the use of inorganic fertilizers unattractive.

Organic fertilizers are an alternative. In addition to supplying needed crop nutrient, they improve soil properties. Organic material such as Cocoa pod husk (CPH), Kola pod husk (KPH) and *Chromoleana odorata* abound. There is need to explore these materials alone or fortified within inorganic fertilizers.

Objective: To determine the effect of organic and organo-mineral fertilizer on growth and early field establishment of cocoa.

Methodology

Field experiment was conducted in Cocoa Research Institute of Nigeria (CRIN) headquarters, Ibadan, Latitude $7^{0}40^{1.}$ Longitude $3^{0}90^{1}$E at 228 meters above sea level. The response of cocoa seedlings to organic, inorganic and organominera fertilizers was tested. The treatments consisted of:

1. Control (No fertilizer)
2. NPK
3. Cocoa pod husk (CPH)
4. Kola pod husk (KPH)
5. *Chromoleana odorata*
6. Poultry dropping
7. Cocoa pod husk (CPH) + Urea (60:40)

These seven treatments were arranged in a Randomized Complete Block Design (RCBD) and replicated three times. The organic fertilizer were applied to supply 10kgN/ha.

The land was cleared, pegged, holes dug and cocoa seedlings transplanted at a spacing of 3.1mx3.1m. Composite soil were collected at soil depths of 0-15, and 15-30cm and bulked to give pre-cropping samples at the beginning of the experiment. Similarly, sampling was done according to treatment for post cropping analysis. The soil was air dried and passed through a 2mm sieve for determination of some of the physical and chemical properties of the soil. The analysis included particle size analysis, organic carbon content, and soil pH, exchangeable acidity ($A1^{3+}$ and H^{+}), Cation exchange capacity. Total N, available P, exchangeable K, Ca, Na Zn and Cu using standard procedures. Agronomic parameter such as plant height, stem girth, leaf area, number of leaves, dry matter accumulation and nutrient uptake was taken monthly beginning from one month after plantin. Data collected was subjected to analysis of variance (Gomez and Gomez, 1984) and means were separated using Duncan multiple range test.

Results and discussion

Response of number of leaves to all the fertilizer treatments were not significant ($P<0.05$) at all the sampling stages (Table 1)

Table 1: Effect of organic, inorganic and organomineral fertilizers on number of leaves and plant height (cm) of cocoa seedling in Ibadan.

	Number of leaves				Plant height (cm)			
Treatments	1MAT	2MAT	3MAT	4MAT	1MAT	2MAT	3MAT	4MAT
No Fertilizer	18	20	23	9	42.3	42.9	43.3^{b}	44.4^{b}
NPK	25	28	31	15	50.7	52.2	53.7^{a}	57.6^{a}
Cocoa Pod Husk(CPH	24	28	30	14	53.0	53.1	54.1^{a}	55.7^{a}
Kola Pod Husk (KPH)	18	21	24	9	43.0	40.3	41.9^{b}	47.6^{b}
Chromoleana odorata	20	23	26	15	51.9	52.5	43.6^{b}	48.3^{b}
Poultry Dropping	18	23	25	14	42.1	41.7	42.0^{b}	45.2^{b}
CPH + Urea (60:40)	19	24	27	10	42.0	43.1	44.2^{b}	45.9^{b}
SE	3.51	3.41	2.52	1.95	4.14	4.51	3.5*	3.92**

Means with the same letter(s) within the same month are not significantly different (P< 0.05) using Duncan Multiple Range Test (DMRT).

Abbreviations

MAT Months after transplanting

* Significant at 5% level of probability

** Significant at 1% level of probability

Though NPK, Cocoa Pod Husk and *Chromoleana odorata* increased number of leaves, this increase were not significant. Similarly observation was made on stem diameter and number of branches (table 2)

Table 2: Effect of organic, inorganic and organomineral fertilizers on number of branches and stem diameter (cm) of cocoa seedlings in Ibadan.

	No. of branches				Stem diameter (Cm)			
	1MAT	2MAT	3MAT	4MAT	1MAT	2MAT	3MAT	4MAT
Treatments								
No Fertilizer	0	0	0	0	0.87	0.96	1.00	1.13
NPK	1	1	2	2	1.17	1.23	1.31	1.33
Cocoa Pod Husk(CPH	0	0	1	2	1.10	1.27	1.35	1.33
Kola Pod Husk (KPH)	0	0	0	2	0.97	1.10	1.26	1.23
Chromoleana odorata	1	1	1	1	1.00	1.10	1.20	1.32
Poultry Dropping	0	0	0	1	1.20	1.0	1.10	1.24
CPH + Urea (60:40)	0	0	0	2	0.90	1.20	1.00	1.07
SE	0.45	0.56	0.55	0.45	0.10	0.12	0.12	0.10

Means with the same letter(s) within the same month are not significantly different (P< 0.05) using Duncan Multiple Range Test (DMRT).

Abbreviations

MAT Months after transplanting

* Significant at 5% level of probability

** Significant at 1% level of probability

Significant (P<0.05) response of plant height to fertilizer was observed at 3 and 4 MAT. NPK and CPH increased plant height by 25% when compared with no fertilizer control at 3 MAT and 30% and 25% respectively when compared with no fertilizer control at 4MAT. Similarly observation was made by Ogunlade *et al* 2006 who observed that all organic fertilizer treatments increase seedling height, number of leaves and stem diameter. This increase could be attributed to the availability of nitrogen from CPH and NPK to the plant at these sampling periods due to mineralization, hence the utilization of this nutrient for growth.

Conclusion

Cocoa pod husk compared favorably with the inorganic fertilizer (NPK) on growth parameter such as plant height at 3 and 4MAT.This could be an indication that Cocoa pod husk could serve as an alternative nutrient source for cocoa seedlings. The experiment is still ongoing, there is therefore need to conclude the experiment.

References

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Experiental Title: Response of cocoa (*Theobroma cacao*) seedlings to varying levels of phosphate fertilizers in Ibadan. **(**Iloiyanomon,C.I)

Introduction

Cocoa bean is an important export crop. In 1960, Nigeria produced 304, 800 metric tonnes of beans (FAOSTAT, 2006), with Nigeria next in production only to Ghana. The advent of the oil boom, led to the neglect of the agricultural sector, hence by 1999, yield had dropped to 225,000 metric tonnes. Despite government's effort to resuscitate the industry, yields are still low.

Reasons for this decline in yield are numerous among which are ageing cocoa plantations, many of which are 40-60 years old and depletion of soil nutrient due to continuous harvesting of cocoa beans without nutrient replenishment (Are, 1967). There is, therefore, need to rehabilitate these moribund cocoa plantations and establish new ones.

The establishment of new cocoa plantations is challenging. This is because of the low nutrient status of the soil. Phosphorous is one of the most limiting nutrients in cocoa, and most arable lands in the tropics are deficient in P (Kummer, 1988). P deficiency has also been reported on many crops in Nigeria (Adepetu, 1983 and Adetunji 1999). The conventional commercial phosphate fertilizers such as single super phosphate triple super at the peak demand (Menon and Chien, 1990; Komolafe, 1997). This, coupled with the need to conserve scarce foreign exchange, has necessitated the search for alternate sources, of fertilizer which are available and environmentally friendly.

Geological survey has shown that extensive deposits of Rock Phosphates can be found in five sedimentary basins in Ogun, Sokoto, Delta, Imo and Anambra States of which Ogun and Sokoto rock phosphate have been found to be in commercial quantity with high elemental P. (Adegoke *et al.*,1989). The use of this rock phosphate as P source is a promising option (Adeniran and Sobulo 1995; Obigbesan and Udosen, 1995). This is because they are relatively available and more environmentally friendly. This, coupled with their liming ability, has made them an attractive alternative as little work has been done on the use of rock phosphate on cocoa in Nigerian soils. There is, therefore, the need to assess Sokoto rock phosphate as an alternative P source. Also, 4-5kgP/ha has been recommended for cocoa seedlings in the year of planting on cleared arable land. There is need to assess this rate and other rates to determine the most effective rate for cocoa seedlings.

Objectives

This study aims to

- Evaluate the effectiveness of Sokoto Rock phosphate as alternative source of Phosphorous for cocoa seedlings,
- Evaluate the effect of varying levels of phosphate fertilizers on growth of cocoa seedlings.

Methodology

The experiment was conducted in the screen house of Cocoa Research Institute of Nigeria (CRIN). The treatments were a factorial combination of two cocoa variety (T12/1233 and T63/970), two types of phosphate fertilizers (Single Superphosphate, Sokoto rock Phosphate and four levels of phosphate fertilizers (0, 4, 8 and 16kgP/ha). These twenty four treatments were arranged in a completely randomized block design with four replications. The soil used for the experiment was an alfisol, collected from 0-15cm depth of an old moribund cocoa plantation within CRIN. The soil was air-dried passed through a 2mm sieve and 5kg weighed into plastic plots. A sub-sample of the soil was taken and analyzed for some of its physical and chemical properties.

Soil pH was determined in soil/water solution of 1:2:5 ratio (Thomas, 1996) and values read with a pH meter. Particle size

analysis was determined by hydrometer method (Gee and Or, 2002) and soil texture determined by using a textural triangle (soil survey staff, 2003). Organic carbon was determined by dichromate wet oxidation method by Walkey and Black (1934) as modified by Allison (1984). Soil organic matter was obtained by multiplying organic carbon by a factor of 1.724. Total Nitrogen was determined by Microkjeldah method (Bremner, 1960). Available P determined by Bray-I method (Bray and Kuntz, 1945) and P in the extract determined colorimetrically by Molybdenum blue method as modified by Murphy and Riley (1962)

Exchangeable bases (K, Ca, Mg, and Na) were extracted by reacting with ammonium acetate (Soil Survey Staff, 2003), and K and Na in the filtrate determined using a flame photometer. Ca and Mg were read using an Atomic absorption spectrophotometer (AAS) (Pratt, 1965a; Pratt, 1965b). Exchangeable acidity was determined by filtration titration method (McLean, 1965). Cation exchange Capacity (CEC) was determined by summation of all cation and effective cation exchange capacity (ECEC) was by summation of exchangeable bases and acids.

Sokoto rock phosphate (SRP) was analyzed for P, Ca, Mg, K, Al, Fe and C.

Data was collected monthly for six months on plant height, no of leaves, stem diameter, stem, root and leaf dry matter and total dry matter were taken at 2, 4 and 6 months after planting (MAP). At these periods, the plants were harvested, roots washed, detached into root, leaf, and stem, oven dried and weighed

Data collected was subjected to analysis of variance (Gomez and Gomez, 1984) and means were separated using Duncan Multiple Range Test (DMRT).

Results and Discussion

Physical and chemical properties of the experimental soil are shown on the table 1. The soil used was sandy loam, slightly acidic with pH of 6.43-6.67. The soil was low in fertility with N, P and K, values of 1-1.1g/kg, 3.17-3.2mg/kg and 0.11- 0.15 cmol/kg respectively. The P and K values fell below the soil critical value of 10mg/kg P and K 0.3cmol/kg soil required for cocoa (Egbe *et al*, 1989). The N content of 1-1.1g/kg was above the soil critical value of 0.9g/kg required for cocoa. The organic carbon was 11.33-11.7g/kg. This was also below the recommended 20% required by cocoa. The soil was from a moribund cocoa plantation.

Effect of phosphate fertilizer on number of leaves was significant ($P<0.05$) at 2 and 7months after planting (MAP) (Table 2). At 2 MAP, the application of Single Super Phosphate (SSP) at the rate of 8 and 16KgP/ha significantly ($P<0.05$) increased number of leaves when compared with SSP applied at the rate of 4kgP/ha and Sokoto Rock Phosphate (SRP) at all levels. However, there was no significant difference between SSP applied at the rate of 16kgP/ha and control. At 7 MAP, increasing SSP rate from 0 to 4kgP/ha had no significant effect on number of leaves. Further increase to 8kgP/ha and 16kgP/ha resulted to increasing leaf number by 8% and 42% when control.16kgP/ha as SSP significantly increased number of leaves by when compared with other treatments. SRP at all levels had no effect on number of leaves. There was no significant different between the two cocoa varieties (Tables 2).

The effect of phosphate fertilizer on plant height was significant ($P<0.05$) only at 4MAP (Table 2), with 4kgP/ha as SSP producing significantly taller plants when compared with all other treatments except 16kgP/ha applied as SSP. This was however not observed at 7MAP. Cocoa variety T12/1223 was superior in height to T63/970 with height increases of 3%, 15%, and 12% when at 2, 4, and 7MAP (Table 2).

Effect of phosphate fertilizers on stem diameter was significant (P<0.05) only at 7MAP (Table 3).Increasing SSP rates from 4 to 8kgP/ha had no significant (P<0.05) effect on plant diameter. However, further increase of SSP from 8kgP/ha to 16kgP/ha resulted in significant increase in stem diameter with increases of 30% when compared with control. SRP at the rate of 4kgP/ha depressed stem diameter, (Table 3) while SRP at the rate of 8 and 16kgP/ha had no effect on stem diameter. There was no significant difference between the two cocoa varieties.

Phosphate fertilizers had no significant effect on root length, stem dry matter (Table 3) root dry matter (Table 4), shoot dry matter and total dry matter (Table 5). Similarly there was no significant difference between the two cocoa varieties in stem dry matter, root length (Table 3) and total dry matter (Table 5). However, the effect of variety on stem dry matter was significant (P<0.05) only at 2MAP (Table 3) with variety T63/970 having significantly higher stem dry matter. This effect was not observed at all the other sampling stages. Similarly. T63/970 had significantly (P<0.05) higher root dry matter at 2 MAP and 4MAP but this was not observed at 7MAP. Cocoa variety T12/1223 was superior in leaf dry matter (Table 4) and shoot dry matter (Table 5).

Table 1: Some physical and chemical properties of the experimental soil.

Parameters	Soil depth. 0-15cm	15-30cm
pH	6.43	6.67
OC (g/kg)	11.7	11.3
N(g/kg)	1.1	1.0
P(mg/kg)	3.2	3.17
K(cmol/kg soil)	0.15	0.11
Ca(cmol/kg soil)	2	1.37
Mg(cmol/kg soil)	2.45	2.22
Na(cmol/kg soil)	0.63	0.42
Exch acidity	0.69	0.63
CEC	3.81	3.06
Zn (mg/kg soil)	3.00	6.6
Cu (mg/kg soil)	4.1	3.52
Mn (mg/kg soil)	4.6	3.7
Fe (mg/kg soil)	5	5.1
Sand (g/kg)	700	724
Silt (g/kg)	160	152
Clay (g/kg)	240	224
Textural Class	Sandy Loam	Sandy Loam

Table 2: Effect of varying levels of phosphate fertilizers on number of leaves and plant height (cm) of cocoa seedling in Ibadan.

	No of leaves			Plant height (cm)		
Treatments	2 MAP	4 MAP	7 MAP	2 MAP	4 MAP	7 MAP
Variety						
T12/1223	11.92	23.18	30.71	25.26a	50.40a	64.2a
T63/970	12.17	23.83	29.31	24.71b	43.75b	57.2b
SED	0.29	1.28	1.93	0.76**	1.52**	2.45**
Fertilizer levels						
O KgP/ha	12.67a	22.92	27.67c	26.93	48.77b	61.6
SSP 4 KgP/ha	11.33b	24.80	29.83bc	24.90	52.27a	63.8
SSP 8 KgP/ha	12.83a	23.33	31.33b	24.55	43.51c	55.2
SSP 16 KgP/ha	13.00a	28.00	39.39a	24.92	50.92ab	67.5
SRP 4 KgP/ha	11.17b	20.20	26.33c	23.33	43.06c	60.3
SRP 8 KgP/ha	11.50b	23.50	29.67c	24.13	45.15c	55.8
SRP 16 KgP/ha	11.17b	22.33	28.17c	24.20	44.17c	59.5
SED	0.59**	2.56	3.87*	1.52	3.09*	4.89
Interaction						
Variety x fertilizer	NS	NS	NS	NS	NS	NS

Means followed by the same letter(s) within the same treatment group and month are not significantly different (P<0.05) using Duncan multiple range test.

Abbreviations

NS Not Significant
MAP Month after planting
SRP Sokoto Rock Phosphat7
* Significant as 5% level of probability
SED Standard Error of Difference
* * Significance as 1% level of probability
SSP Single Super phosphate

Table 3: Effect of varying levels of phosphate fertilizers on stem diameter (cm), stem dry matter (g) and root length (cm) of cocoa seedlings in Ibadan.

	Stem diameter (cm)			Stem dry matter (cm)			Root length (cm)
Treatments	2 MAP	4 MAP	7 MAP	2 MAP	4 MAP	7 MAP	7 MAP
Variety							
T12/1223	0.44	0.93	1.012	1.38b	3.79	16.17	41.8
T63/1970	0.45	0.86	0.987	1.55a	3.79	13.33	43.6
SED	0.07	0.34	1.63	0.07*	0.34	1.63	2.77
Fertilizer levels							
O KgP/ha	0.46	0.98	0.98bc	1.57	3.42	14.17	42.1
SSP 4 KgP/ha	0.43	0.99	1.05b	1.30	4.10	16.33	36.9
SSP 8 KgP/ha	0.44	0.99	0.98bc	1.58	3.84	15.33	43.1
SSP 16 KgP/ha	0.40	0.87	1.27a	1.36	4.48	17.58	45.5
SRP 4 KgP/ha	0.44	0.77	0.87d	1.28	4.64	11.75	41.6
SRP 8 KgP/ha	0.43	0.79	0.93bc	1.64	4.04	14.33	42.0
SRP 16 KgP/ha	0.45	0.78	0.93bc	1.40	2.97	13.50	48.4
SED	0.02	0.14	0.07**	0.15	0.68	3.26	5.53
Interaction							
Variety x fertilizer	NS	NS	*	NS	NS	NS	NS

Means with the same letter(s) within the same treatment group and month are not significantly different at (P<0.5) using Duncan multiple range test.

Abbreviations

NS Not Significant
MAP Month after planting
* Significant as 5% level of probability
SED Standard Error of Difference
* * Significance as 1% level of probability
SSP Single Super phosphate
SRP Sokoto Rock Phosphate

Table 4: Effect of varying levels of phosphate fertilizers on root dry matter (g) and leaf dry matter (gm of cocoa seedlings in Ibadan.

	Root dry matter (g)			Leaf dry matter (g)		
Treatments	2 MAP	4 MAP	7 MAP	2 MAP	4 MAP	7 MAP
Variety						
T12/1223	0.62b	2.00b	11.44	2.41	7.70	15.63a
T63/970	0.77a	2.46a	9.96	2.35	7.73	12.92b
SED	0.06*	0.22*	1.06	0.16	0.59	0.97**
Fertilizer Levels						
O KgP/ha	0.83	1.95	9.55	2.60	6.72b	13.35
SSP 4 KgP/ha	0.67	2.38	11.67	2.32	9.33a	16.33
SSP 8 KgP/ha	0.67	2.66	12.50	2.82	7.24b	15.30
SSP 16 KgP/ha	0.52	2.52	14.08	2.25	9.25a	15.13
SRP 4 KgP/ha	0.58	2.17	8.92	2.13	9.20a	12.05
SRP 8 KgP/ha	0.75	2.33	9.00	1.95	7.21b	14.38
SRP 16 KgP/ha	0.72	1.87	10.33	2.37	6.05c	14.50
SED	0.13	0.43	2.11	0.31	1.18*	1.93
Interaction						
Variety x fertilizer	NS	NS	NS	NS	NS	NS

Means with the same letter(s) within the same treatment group and month are not significantly different at (P<0.5) using Duncan multiple range test.

Abbreviations

NS Not Significant
MAP Month after planting
* Significant as 5% level of probability
SED Standard Error of Difference
* * Significance as 1% level of probability
SSP Single Super phosphate
SRP Sokoto Rock Phosphate

Table 5: Effect of varying levels of phosphate fertilizers on shoot dry matter (g) and total dry matter (g) of cocoa seedlings in Ibadan.

	Shoot dry matter (g)			Total dry matter (g)		
Treatments	2 MAP	4 MAP	7 MAP	2 MAP	4 MAP	7 MAP
Variety						
T12/1223	3.81	11.49	31.8a	4.37	13.49	42.8
T63/970	3.90	11.30	26.1b	4.68	13.75	36.7
SED	0.22	0.79	2.33	0.24	0.96	3.15
Fertilizer Levels						
O KgP/ha	4.17	10.13	27.5	4.87	12.09	38.95
SSP 4 KgP/ha	3.62	13.35	32.7	4.28	15.73	44.33
SSP 8 KgP/ha	4.40	11.12	30.8	5.07	13.78	38.3
SSP 16 KgP/ha	3.65	13.72	32.7	4.24	16.25	46.9
SRP 4 KgP/ha	3.42	12.25	23.8	4.00	14.41	32.8
SRP 8 KgP/ha	3.66	11.30	28.7	4.46	13.63	39.4
SRP 16 KgP/ha	3.74	9.13	28.0	4.43	11.00	38.3
SED	0.44	1.57	4.66	0.47	1.92	6.30
Interaction						
Variety x fertilizer	NS	NS	NS	NS	NS	NS

Means with the same letter(s) within the same treatment group and month are not significantly different at (P<0.5) using Duncan multiple range test.

Abbreviations

NS Not Significant
MAP Month after planting
SRP Sokoto Rock Phosphate
* Significant as 5% level of probability
SED Standard Error of Difference
* * Significance as 1% level of probability
SSP Single Super phosphate

The positive response of cocoa seedlings to 16kgP as SSP could be attributed to the low available P status of the soil (3.2mg/kg) when compared with soil critical P value of 10mg/kg required for cocoa and the quick release of P205 from SSP when compared with SRP hence improved nutrient availability resulting to increased uptake and better growth in form of leaf number and stem diameter.

The non-response of cocoa seedlings to SRP at all levels could be attributed to slow release of phosphorous in SRP due to slow materialization. The P_20_5 in SRP was therefore not available during the period of the experiment and might be available for longer period on the field, for a tree crop like cocoa. Similar observation was made by (Aisueni and Ekhator 2009) in the green house who observed that SRP alone did not significantly enhance palm growth in the green house. Imogi *et al* also observed that palm trees on the field treated with SRP and crystallizer had no effect on branch number and palm yield until after 5 years of fertilizer application.

Conclusion

Soils of moribund cocoa plantation or previously cropped lands with low soil available P, 16k g P ($37kgP_2 0_5$)/ha could be applied. The use of SRP application could be beneficial for longer period on the field for tree crops such as cocoa. There is need to carry out evaluation of SRP on the field.

CASHEW PROGRAMME

Experimental Title: A preliminary report on the damage characteristics of *helopeltis anacardii* on *anacardium occidentale* l. (Mokwunye, I.U; and T.C.N. Ndubuaku)

Introduction

The cashew, *Anacardium occidentale* L., a resilient and fast- growing evergreen tree. Native to North-eastern Brazil, the cashew was introduced to Nigeria by Portuguese traders in the 15th and 16th century. The crops grows well in almost all the agroecological zones in Nigeria. It is important nut crop that provides food, employment and foreign exchange to many in developing countries.

The known economic insect pests of cashew are *Analeptes trifasciata* Fabricius (Coleoptera: Cerambycidae) which girdles stems and branches, the red-banded thrips- *Selenothrips rubrocinctus* Giard (Thysanoptera: Thripidae) which attack the leaves and the fruit scrapper- *Pachnoda cordata* Drury (Coleoptera : Scarabaeidae) in descending order of importance (Adeyemo and Okelana, 1989). Following field observations and reports from the CRIN HQ, Ibadan and CRIN sub-station, Ochaja, Kogi State of the devastating occurrence of the inflorescence and twig dieback on both mature and young stands on the plots, it became imperative to understand the source and a search through literatures revealed that *Helopeltis anacardii*, a bug is involved in the dieback condition. *Helopeltis* spp are the most serious insect pests of cashew in the tropics (Stonedahl 1991).

This insect causes serious damage to the tender shoots, the inflorescence, the developing apple and the young nut. Peng *et al*. (1995) reported that the tree can be completely destroyed by this pest. It was against this backdrop that this investigation was carried out to monitor the seasonal distribution insect pest for the purpose of an effective control.

Materials and Methods:

This research activity was carried out on a 1ha cashew germplasm plantation located at the CRIN Head -quarters in Ibadan. The cashew plantation was established in 2005 and planted in geometry of 6m by 6 m with a total of 320 stands. Ibadan has an annual rainfall average of 2000mm with a bimodal pattern. CRIN is located in the humid rainforest ecosystem with mean solar radiation of 18mj/m^2/day. It lies between the latitude 7º30'Nand longitude 3º 54'E at an altitude of 200m above sea level.

Twenty mature trees were randomly sampled on a fortnightly basis from the base to girth at breast height of 1.5m for the bug. They were collected by means of sweep nets. Parameters measured were the total number of fresh flushes, numbers of freshly damaged flushes and the number of *H.anacardii* found.

Damage Assessment

The adult bugs were collected from the field and bagged in muslin cloths which were attached to cashew shoots. They were monitored daily for 1 week to determine their mode of feeding, parts of cashew plant fed on and their feeding signs.

Result and Discussion

Table 1 shows the mean fresh damage caused by *H.anacardii* during the field survey on cashew plantation between July 2008 and April 2009. The bug was present at varying levels of infestations throughout the period of survey. The highest mean fresh damage of 46% was observed in August 2008 closely followed by 38.5% in September. The lowest mean fresh damage of 11.06% and 12.26% were noted in March 2009 and November 2008, respectively. Field collection of the bug showed that the males were consistently slightly more than females, which may be an indication that the eggs had high probability to be fertilized and hatched. It was also observed that males are slender and smaller in size compared to the females with enlarged abdomen.

In previous studies carried out in Nigeria on the survey of cashew insect pests, *H.*

anacardii was not included as a major pest of cashew nevertheless, this preliminary studies indicates the incidence of this bug all year round on cashew plantation; this corroborates Mokwunye *et al*., 2008. The population size is closely related to the flushing and flowering seasons of cashew due to the abundance of food source. This insect causes serious damage to the tender leaves, the growing tips, inflorescence, apple and nuts (Peng *et al*., 1998). They suck sap from the host plant and the feeding sites are marked by black patches which elongates after some days and in some cases, gum exudes from the site. And in case of severe infestation, it can lead to dieback caused by secondary infestation of fungi.

Table 1: The mean fresh damage percentage of *H.anacardii* on *A. occidentale* in CRIN Germplasm plot, CRIN, Ibadan.

Months	Mean nos. of new flushes	Mean nos. of fresh damage	% damage
July '08	23.45	8.55	36.46
Aug. '08	10.00	4.60	46.00
Sept. '08	4.20	1.60	38.50
Oct. '08	29.28	6.20	21.18
Nov.'08	28.35	3.48	12.26
Dec. '08	32.80	8.03	24.49
Jan.'09	40.78	8.55	21.0
Feb. '09	25.03	3.85	15.38
March '09	35.25	3.9	11.06
April '09	29.47	5.10	17.31

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Experimental Title: Effects of organo-minerals and Inorganic fertilizer on the performance of cashew seedlings **(**Adebowale L.A, Daniel M.A, Ogunlade M.O, and Akanbi O.S .O)

Introduction

Cashew is a tropical crop which belongs to the family Anarcadiaceae and is a native to arid north eastern Brazil. Cashew is an

important nut crop that provides food, employment and foreign exchange to many in developing nations. Of all nuts, cashew is second only to the almond in commercial importance (Rosengarten, 1984). Cashew thrives at temperature of up to 40c (105f).The price of inorganic fertilizers can neither be predicted nor controlled since the basic raw materials have to be imported (Fagbenro and Agboola 1983).The federal government reduced (if not totally removed) subsidies on fertilizers that are available (Olaniyan *et al* 2000).While poor farmers fund and untimely availability of the fertilizers have always limited access to fertilizers.

Soil productivity and its sustainability has been one of the major constraints of tropical Agriculture, the continuous use of inorganic fertilizers has been found to only increase yield for some years but in the long run leads to decreasing base saturation ,acidification and a drop in pH (Phicot et al,1981,Isherwood 2000). Agboola and Obigbesan, 1975, Schridar *et al* 1985,Akanbi *et al*, 2004) reported that the combination of minerals and organic fertilizers termed Organo-mineral (OMF) has been found to improve the productivity of tropical soils more than the sole use either of the two types of fertilizers.

Materials and Method: The experiment was carried out in the greenhouse at Cocoa Research Institute of Nigeria (CRIN) Headquarter Ibadan. Top soils were collected at cashew plots, Ibadan at 0-15cm depth. The soil samples were air- dried for two weeks and crushed, sieved using 2mm sieve. Sixty-three plastics pots each filled with 5kg soil .The cashew nuts were soaked in water to determine viability. Two viable cashew nuts were planted in each 5kg plastic bucket containing 5kg of top soils. Two Organo – mineral fertilizer (A-fortified with urea and B-non fortified) were collected from Pace-setter mineral fertilizers plant, Bodija, Ibadan. Organo- mineral fertilizer A and B were applied at 0, 10,20kgN/ha and NPK 15:15:15 at 0, 10,20kgN/ha were used. All treatment were replicated and set up in greenhouse in a completely randomised design (CRD).Seven fertilizer treatments applied on three cashew nut sizes to gives twenty-one treatment replicates three times were used for the experiment. Agronomic growth parameters were taken monthly basis.

Results and Discussion

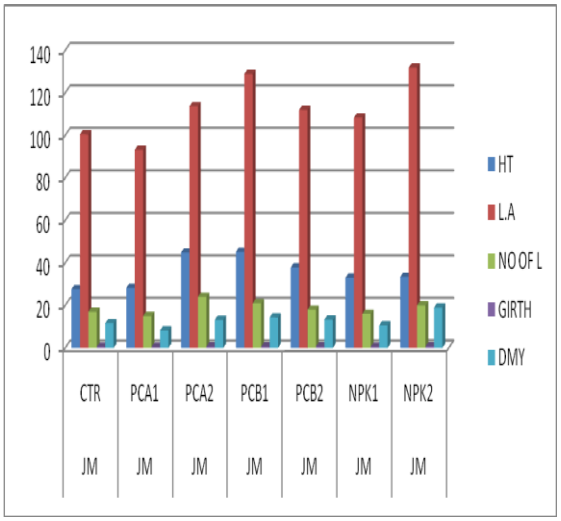

Figure1: Effect of organominerals fertilizer on the growth and dry matter yield of jumbo nut cashew seedlings

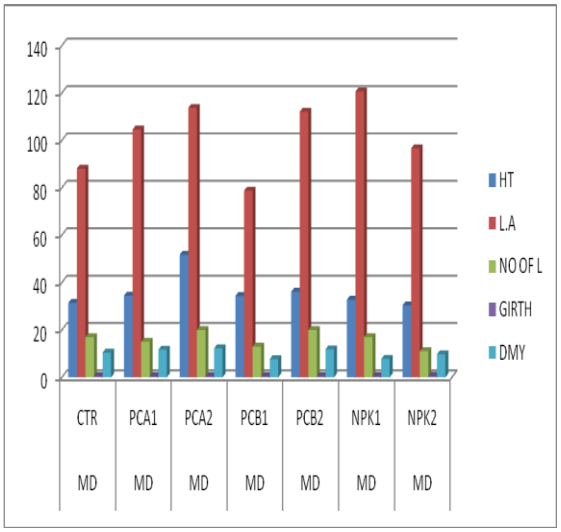

Figure 2: Effect of organo-minerals fertilizer on the growth and dry matter yield of medium nut cashew seedlings

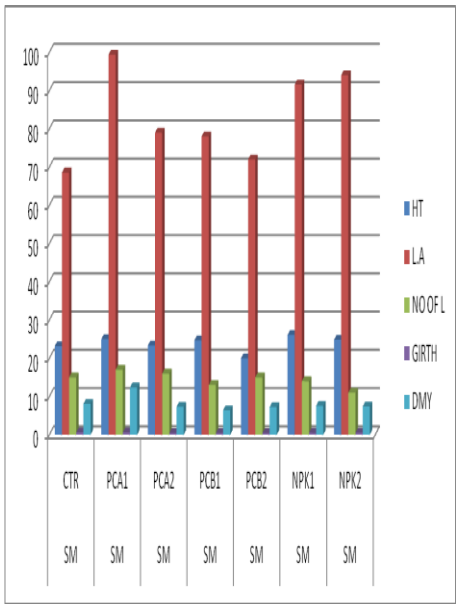

Figure 3: Effect of organominerals fertilizer on the growth and dry matter yield of small nut cashew seedlings

Discussion

From figure1 above shows, the effect of organo-mineral fertilizer on the growth and dry matter yield of cashew seedlings jumbo nuts. Treatment of NPK at 20ton/ha has the highest value for leaf area of 131.90cm but no significant difference in PCB at 10ton/ha. But however, Pacesetter A (PCA) at 10ton/ha had the lowest value, compare to the control and all the other treatments though there was there is no significant between them. In terms of plant height, PCB at 10ton/ha has the highest value of 45.20cm,followed by PCA at 20ton/ha has the value of 44.92cm but no significant difference compare to other treatment. For dry matter yield NPK at 20ton/ha has the highest dry matter weight of 0.70gm, though PCB at 10ton/ha and PCB at 20ton/ha have no significant difference. On girth NPK at 20ton/ha has the highest value of 0.70, but no significance difference between other treatment. At PCA 20ton/ha and PCB 10ton/ha have the highest value of number of 20, compare to other treatments.

Figure 2 shows the effect of organo-mineral fertilizer on the growth and dry matter yield of cashew seedlings medium nuts. In terms of plant height, PCA at 20ton/ha shows the highest value of 51.73cm, but no difference in other treatments. For leaf area it shows NPK at 10ton/ha shows the highest value of 120.60cm compared to other treatment. PCA at 20ton/ha and PCB at 20ton/ha have the highest value 0f 20 of number of leaves, compared to control, PCA at 10ton/ha, PCB at 20ton/ha and NPK at 10ton/ha while the NPK at 20ton/ha has the least value of 11 number of leaves. It shows that NPK at 20ton/ha has the highest girth value of 0.64 compare to others treatments. Dry matter yield of PCA at 20ton/ha has the highest value of 12.20 follow by PCB at 20ton/ha has the value of 11.83 and compare to other treatment.

In Figure 3 as shown above, the effect of organo-mineral fertilizer on the growth and dry matter yield of cashew seedlings small nuts. It shows that PCA at 10ton/ha has the highest value of 99.40 cm on leave area compare to all, While the control had the lowest value of 68.57 of leaf area. In terms of height ,NPK at 10ton/ha had the highest value has indicated on the graph follow by PCA at 10ton/ha has value of 25.00cm,while PCB at 20ton/ha has the least value of 20cm. PCA at 10ton/ha shows the highest girth value of 0.59,but no significance difference compare to other treatments. PCA at 10tons/ha has the highest no of leaves of value of 17.00, follow by PCA at 20tons/ha has value of 16.00,while NPK at 20tons/ha has the lowest value of 11.00 no of leaves for the plant . In terms of dry weight, PCA at 10tons/ha has the highest value of 8.10gm,while PCB at 10tons/ha have the lowest dry matter weight of 6.4gm.

Conclussion

From the results above it shows that organomineral fertilizer known as PCA at 20ton/ha for medium nut sizes have the highest value of plant height (51.73cm). NPK at 20ton/ha for Jumbo nut sizes have the highest leave area of value 131.90cm. In terms of PCA1, PCA2, and PCB1, have the highest number of leaves for both nut sizes. In dry matter yield it shows that PCA2 have the highest value in medium nut sizes compare to other treatments. It showed from results that organomineral fertilizer A and B perform better compared to inorganic fertilizer .Due to scarcity, and too costly of inorganic fertilizer, organomineral fertilizer was readily available, cheaper and easy to have access.

Constraints: Insufficient fund.

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Experimental Title: Evaluation of water requirement of cashew seedlings (green-house) (Daniel M.A Ibiremo, O.S Ogunlade M.O)

Introduction:

The establishment of Cashew seedlings has been faced with a lot of water stress thereby resulting in very low percentage of establishment of seedlings. Though among all the tree crops, cashew tends to be adaptable to wide range of climatic variability with little to water stress. Irrigation has been reported to be of the best way of salvaging the young seedlings especially during the first 3 - 4 years of field establishment. Hence this study was carried out to evaluate the water requirement of cashew seedlings the green house

Methodology

Composite soil samples were collated from cashew plantation at 0-30cm, air dried, and sieve to pass through 2mm sieve. Sub samples were collected for analysis and water holding Capacity (Gravimetic methods) determined. The sieved soil samples were put in 5 ltrs plastic pots perforated at the bottom and arrange at 30cm distance. Cashew nuts were collected and sown in each of the pot in the green house.

A storex tank of 2000lts capacity was placed on a brick stand and main pipes of thickness, sub-mains and laterals with drippers at 30cm each were placed at the centre of each pot, the pot were arranged in a complete randomized design with four replicates and the water application were scheduled as

- According to drippers = on lateral with 5.6 m3/h
- Duration of application= to be determine
- Days of application = to be determine.
-

Factors that were considered during the experiment were as follows

Crop Type	Growth	Period	Soil Type	Irrigation Method
A Growth stage			days	
B. Stage length			date	
C. Period			mm	
D. Precnt/stage			%	
E. Precn/effves			mm	
F. Eff.prec. F=D./100			mm	
H. Net. Eva:s S=G.B			mm	
I FC/WT			%	
J FC/WT			%	
K. WP/WT			%	
L. Aval. Mois/N+mm			%	
M. BD			g/cm3	
N. Aval. Mois/M+L			%	
O. Avail. rZDe			cm	
P. Avail.H20 rz P=O* N/100			mm	
Q Allow. Deplin			%	
R. Allow Defic R=Q*P/100			%	
S. Witted area			%	
T. Crop coef.			%	

Table 1: Physical and chemical properties of the soil used.

Soil properties	Values
pH (H_2O)	6.43
Sand g/kg	685.00
Silt ''	149.00
Clay ''	165.00
Total N ''	0.82
Avil.P mg/kg	9.68
Exch. K Cmol/kg	0.96
Mg ''	2.03
Ca ''	0.37
Org.C g/kg	1.00
Texture	sandy clay loam

Table 2: Irrigation schedule calculations Crop type: cashew; growth period: seedlings; soil type: alfisol irrigation method**:** pressurized drip

Equation	unit	Value
A. Growth stg	days	180
B. Stage leng	date	
C. Period	mm	50
D. Precn/stag	%	75
E. Precn/eff	mm	37.5
F. Eff.prec. F=D./100	mm	11
H. Net. Eva:s?S=G.B	mm	1980
I FC/WT	%	1942
J FC/WT	%	20
K. WP/WT	%	12
L. Aval. Mois/N+mm	%	8
M. BD	g/cm3	1.5
N. Aval. Mois/M+L	%	12
O. Avail. 1ZDe	cm	45
P. Avail.H20 2 P=O* N/100	mm	5.40
Q Allow. Depli	%	25
R. Allow Defic R=Q*P/100	%	1.35
S. Witted area	%	75
T. Crop coef.	%	0.35

Results

The result of the soil of the study area is presented in (Table 1) .While that of water requirement is presented in (Table 2). The growth stage of cashew seedlings in the green house for six months (180 days) which show that, the stage length was 180 days with percentage of stages 50mm. The percentage effectiveness of water was found to be around 55% while average evaporation was found to be about 11mm with total evaporation 1980mm. This could be attributed to the high relative humidity and the prevailing temperature.

Mean while net evaporation, field capacity and welting points were found to be minimal. The resultant outcome of the above parameters was the low available moisture. There was no significant changes in the bulk density while available moisture in the root zone remain at 45 and 5.4mm respectively after allowable depletion of 25% ,a deficit of 1.35mm was obtained showing that there was a wetted area of 65% (Table 2).

The crop coefficient of 0.3 was found to be ideal for seedling stage (in the green house). Therefore, from the ongoing, the available daily water for cashew seedlings of 3.66mm was found to be ideal. The interval between irrigation will deepen on the clay content of the soil .The determination of net water requirement, irrigation efficiency and water application rate is ongoing.

Conclusion:
The amount of water required in the green house need to be further studied in the field before a conclusive water requirement can be given.

Constraints: Untimely release of fund affected prompt supply of water and other needed input.

Location: Ibadan.

Level of Implementation: Green house one-going, field trails to start soon

Status: On-going

Outlook: Field evaluation is necessary in ideal conditions.

Table 1: Physical and chemical properties of the soil used.

Table 2: Irrigation schedule calculations Crop type: cashew; growth period: seedlings; soil type alfisol irrigation method: pressurized drip

Equation	unit	Value
A Growth stage	days	180
B. Stage length	date	
C. Period	mm	50
D. Precn/stag	%	75
E. Precn/eff	mm	37.5
F. Eff.prec. F=D./100	mm	11
G Aval.daily.Eva	mm	
H. Total.Eva./s H=G*B	mm	1980
I Net. Eva:s I=H-F	mm	1942
J FC/WT	%	20
K. WP/WT	%	12
L. Aval. Mois L=J-K	%	8
M. BD	g/cm3	1.5
N. Aval. Mois/M*L	%	12
O. Avail. rzDepth	cm	45
P. Avail.H_20 rz P=O* N/100	mm	5.40
Q Allow. Depli	%	25
R. Allow Defic R=Q*P/100	%	1.35
S. Witted area	%	75
T. Crop coeff.	%	0.35
U Av,Dail.H_2O U = T*1/B	mm	Not yet determine
V Interv,btwirr V =B/U	days	''
W Net H_2O an W= U*V*10	m^3/ha	''
X Irrn.eff.	%	''
Y H_2O appln Y=w(100)	m3/ha	

COFFEE PROGRAMME

Experimental Title: Frequency of occurrence and geographical distribution of plant-parasitic nematodes on coffee in Nigeria (Orisajo, S.B., Fademi, O.A. Okeniyi, M.O. and Dongo, L.N.)

Introduction
Coffee is an important crop and extensively cultivated in about 60 tropical and subtropical countries. The main regions of coffee production over the world are South America (45%), Asia and Oceania (26. %), Africa (13 %), Mexico and Central America (16%) (ICO, 2010). Coffee is a major source for foreign exchange, and contributes significantly to the economy of developing countries (Waller *et al*., 2007). But, coffee production in Africa has largely stagnated over the past two decades. This reduction in production has been attributed to a number of factors including poor management practices,

soil infertility, inconsistent government policies, poor pricing and losses due to damage by pests and diseases (Musoli *et* a*l*., 2001). Pest populations, nematodes for example, may build up to damaging levels in perennial crops, and coffee is no exception (Waller *et al*., 2007).

Plant-parasitic nematodes have a substantial economic impact on coffee in most coffee-producing countries. They are regarded as the major limiting factor in coffee production and worldwide coffee losses have been estimated to approximately 15% (Campos & Villain, 2005). In Nigeria, there is a paucity of information regarding plant-parasitic nematode species associated with coffee. Hence, a survey of the major coffee-growing region of the nation becomes imperative. This will provide a good picture of the distribution of nematodes in different locations where coffee is grown and assist in identifying coffee cultivars resistant to these plant-parasitic nematodes. Therefore, an extensive survey of the coffee production areas of the country was conducted to obtain information on potentially harmful plant-parasitic nematodes associated with coffee species, both in soil and in roots.

Materials and Methods

Nematode Survey

Nematological surveys were carried out in seven localities in six States with coffee farms, experimental fields or germplasm plots, representative of the coffee producing areas of Nigeria in 2010. These include: Kusuku (Taraba State) where *Coffea arabica* (Arabica coffee) is grown, while Ajassor, Okundi (Cross-River State), Uhonmora (Edo State), Kabba (Kogi State), Owena (Ondo State) and Ibadan (Oyo State) grow *Coffea canephora* (Robusta coffee). A total of 320 soil and root samples were collected from the rhizosphere region about 50-70 cm from the base of the plants and at a depth of 20 cm. The altitudes of the sampled areas were 1,460, 122, 121, 140, 440, 178 and 122 meters above sea level for Kusuku, Ajassor, Okundi, Uhonmora, Kabba, Owena and Ibadan, respectively.

Processing of soil and root samples

Aliquots of 250cm^3 sub-sample soil from 500cm^3 each composite sample were assayed for nematodes by sieving and decanting (Cobb, 1918). After decanting, the sediment was assayed for nematodes using the Whitehead & Hemming (1965) tray modification of Baermann (1917) technique as described by Coyne *et al*. 2007. The root samples were washed, pooled, chopped into approximately 1-cm-pieces and thoroughly mixed. A 5g sub-sample was put in 100ml water in a kitchen blender. The root was macerated 3 times for 10 seconds, separated by 5 seconds intervals, and the nematodes were extracted from the resulting homogenate using sieve method (Speijer & De Waele, 1997). The nematode suspension was diluted with water in a graduated cylinder to 10ml.

Prior to counting, solution containing nematodes were agitated thoroughly and nematode populations were determined in 1 ml distilled water suspension in a counting dish (Doncaster, 1962) under a stereomicroscope and expressed per 250cm^3 soil or 5 g roots. A mean of 3 counts was taken in each case. Nematodes were transferred with an eye lash picker to a slide with a drop of water, covered (with a cover slip) and examined under a compound microscope with a 40, 60 and 100X objective for identification using taxonomic keys (Hunt *et al*., 2005) and counted. The identification and counting was repeated three times and mean population of nematodes/sample calculated.

Pathogenicity Tests:

Coffea arabica and *C. canephora* seedlings collected from the locations were allowed to stabilize in the sreenhouse for two weeks and thereafter subjected to pathogenicity tests. The pots with the coffee seedlings were inoculated with 5,000 *Meloidogne incognita* eggs obtained from the pure culture on the roots of *Celosea argentea* using Hussey and Barker (1973) sodium hypochlorite (NaOCl) method. Uninoculated units served as control. Normal watering of seedlings as obtains in coffee nurseries was carried out. Fortnightly, growth parameters such as plant height, stem girth, and numbers of leaves were recorded. The experiment was terminated 24 weeks after inoculation. To assess infection the roots were carefully freed of soil, washed under a gentle stream of tap water, mopped and galls counted using a hand lens at 3-5 X magnification. Root galling was assessed using the 0-5 gall index (Sasser *et al*., 1984). Nematode eggs were collected from each root system using sodium hypochlorite method (NaOCl) of Hussey and Barker (1973) and counted. Aliquots of 250cm^3 soil samples from each pot were assayed for juveniles of *M. incognita* using the modified Baermann technique (Coyne *et al*., 2007).

Data Analysis

Prior to statistical analyses, data were checked for normality and homogeneity of variances, and transformed where necessary. A log transformation [log10(x + 1)] was applied to the data on nematodes (densities per 250cm^3 soil, densities per gram root and gall index). The determination of disease incidence was based on the nematode population per root system and it was expressed by the number of egg masses and gall index. The numbers of egg masses were counted and gall index (GI) and egg mass index (EMI) were determined on the following scale: 0 = 0; 1 = 1 – 2; 2 = 3 – 10; 3 = 11 – 30; 4 = 31 - 100 and 5 = greater than 100 galls or egg masses per root system (Taylor and Sasser, 1978, Sasser *et al*., 1984). Reproduction factor of the nematode (Rf) = final nematode population (pf) × initial nematode population (pi) $^{-1}$. All data collected were subjected to analysis of variance and significant differences between means were evaluated using Least Significant Difference Method at $P<0.05$.. All analyses were performed using GENSTAT (version 7.1, VSN International Ltd., Lawes Agricultural Trust, Hempstead, UK).

Results

Plant-parasitic nematodes were detected in 82 out of the 320 collected root samples and in all 320 soil samples. From these latter samples14 genera of plant-parasitic nematodes were recovered (Table 1). Nematodes recorded from soil samples were predominantly endoparasitic species, *viz*. *Meloidogyne* spp., *Pratylenchus coffeae* and *Rotylenchulus reniformis*. These species occurred in 82, 51 and 5% of all soil samples per 250 cm^3 soil, respectively. *Rotylenchulus reniformis* was recovered only from Kusuku soil. Ectoparasitic species identified from soil samples were mainly represented by *Helicotylenchus coffeae*, *Xiphinema* spp. and *Radopholus* spp. Other ectoparasites found were *Criconemoides xenoplax, Scutellonema brachyurus* and *Trichodorus* spp. *Meloidogyne* spp. and *Pratylenchus coffeae* were the only plant-parasitic nematodes recovered from coffee roots. Root-knot nematodes, *Meloidogyne incognita*,

suppressed the growth of coffee seedlings significantly ($P<0.05$) 24 weeks after inoculation (Table 2). The nematode reproduced successfully on both *C. arabica* and *C. canephora* with the latter having the higher reproduction factor (Table 2). Galls typical of root-knot nematodes were observed on the roots of the inoculated seedlings.

Discussion

Our survey yielded an extensive list of both endoparasitic and ectoparasitic plant nematodes as

Parasites of coffee. Most of the detected species are among the most commonly observed and destructive nematodes on coffee (Campos & Villain, 2005). Root-knot nematodes are more widely distributed throughout the world in coffee plantations than any other major group of parasitic nematodes. To date 17 species of *Meloidogyne* are reported on this crop (Campos & Villain, 2005). During our survey, *Meloidogyne* spp. was recovered in all the localities and specific galls caused by root-knot nematodes were found in the nursery. Second-stage juveniles of *Meloidogyne* were quite abundant in the soil samples. During a survey, Nguyen and Nguyen (2001) found *M. incognita* in the Western Highlands of Vietnam. *Meloidogyne coffeicola, M. paranaensis and M.incognita* caused peeling and cracking of roots but did not produce typical galls in coffee, whereas *M.exigua* caused typical galls easy to recognize in the field (Campos & Villain, 2005).

Pratylenchus coffeae, initially described on coffee in Java by Zimmermann (1898), is still the most widely reported species of root lesion nematodes in coffee worldwide. Both, *P. brachyurus* and *P. coffeae* are parasitic on coffee and although generally less harmful than *M. incognita*, they can cause important yield losses (Phan *et al*., 2001; Tran, 2002). *Pratylenchus coffeae* was recovered from coffee soils in Nigeria during the present survey. Although ecto- and semi-endoparasitic nematodes are reported associated with coffee by many surveys, they are considered of minor importance to coffee (Souza, 2008). However, *R. reniformis* is reported to cause damage to coffee in India (Anonymous, 1966), the Philippines (Valdez, 1968), in Brazil (Lordello, 1980), in New Guinea, Fiji and Western Samoa (Bridge, 1988). In our survey, *R. reniformis* was recovered only from coffee soil in Kusuku.

The perennial character of coffee makes the control of plant-parasitic nematodes in this crop difficult. Increasing concern about environmental contamination by pesticides should necessitate the development of non-chemical strategies to overcome the negative impact of parasitic nematodes on coffee in Nigeria. Pre-planting sampling strategies should be taken to predict the impact of the nematode populations and enable preventive measures to be taken. In infected fields, the spread of the nematodes might be controlled by destroying nematode infected coffee seedlings and weeds. The existence of plant resistance or tolerance to these nematodes should be examined.

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Table 1. Frequency of occurrence and distribution of plant-parasitic nematodes recovered from soils and roots of coffee in selected coffee localities in Nigeria.

Nematode species	Frequency of occurrence (%) at various locations						
	Ibadan	Kunaku	Ajassor	Okundi	Uhonmora	Kabba	Ovena
Meloidogyne spp.	82* (21)#	86 (20)	84 (18)	76 (4)	72 (25)	87 (29)	89 (30)
Helicotylenchus coffeae	45 (-)	41 (-)	59 (-)	49 (-)	63 (-)	51 (-)	53 (-)
Xiphinema spp.	46 (-)	20 (-)	23 (-)	18 (-)	26 (-)	37 (-)	34 (-)
Criconemoides xenoplax	- (-)	2 (-)	1(-)	1 (-)	12 (-)	1 (-)	1 (-)
Pratylenchus coffeae	58 (36)	37 (12)	34 (8)	17 (-)	41 (5)	10 (-)	31 (3)
Scutellonema brachyurus	- (-)	14 (-)	18 (-)	9 (-)	1 (-)	12 (-)	7 (-)
Hemicycliophora spp	- (-)	8 (-)	9 (-)	2 (-)	1 (-)	10 (-)	13 (-)
Radopholus spp.	34 (-)	44 (-)	32 (-)	38 (-)	49 (-)	41 (-)	32 (-)
Rotylenchulus reniformis	43 (-)	-(-)	-(-)	-(-)	-(-)	-(-)	- (-)
Trichodorus spp	- (-)	12 (-)	10 (-)	8 (-)	1 (-)	7 (-)	11 (-)

* nematodes recovered from 250 cm^3soil samples from the coffee rhizosphere

values in parenthesis connote nematodes recovered from 5g coffee roots

Table 2. Effect of root-knot nematode, Meloidogyne incognita, on some growth parameters of coffee seedlings at 24 weeks after inoculation.

Coffee seedlings	Plant height* (cm)	No of leaves (count)	Stem girth (cm)	GI/EMI (count)	Reproduction factor (Rf) (pf/pi)#
C. arabica	14.20b	15.13a	0.38b	4/4	15.1
Control	19.51a	15.14a	0.53a		
C. canephora	12.67c	15.33a	0.36b	4/4	16.4
Control	19.34a	15.14a	0.51a		

* Means followed by the same letter in the same column are not significantly different (P<0.05). #pf = final nematode population, pi = initial nematode population. Where GI = gall index, EMI = egg mass index.

Experimental Title: The use of trap plants for the control of *Cephonodes hylas* (Lepidoptera: Sphingidae) on *coffea canephora* (Okelana, F.A., Oyedokun A.V. and Anikwe J.C.)

Introduction: The Oriental bee-hawk moth *Cephonodes hylas* (L) (Lepidoptera: Sphingidae) is one of the major defoliator insect pests of robusta coffee *(Coffea canephora* Pierre ex. Froehner) in Nigeria. The caterpillars of the moth are known to grow to a much larger size and devour a greater amount of coffee leaves (including tender shoot tips) than other foliage pests, thereby stripping the shrubs quickly. It feeds on the flushes of coffee; hence it has an immediate and direct effect on the yield of the crop. The damage at times, resulted in plant loss (Okelana, 2000).

Objective: To monitor the incidence of the pest on identified host plants in the field, study the biology of *C. hylas* on the host plants and determine the phytochemical constituents of the selected plants with a view to selecting those suitable for use a strap plants for the pest in a coffee orchard.

Materials and Methods: Stands of robusta coffee, various single *Ixora* species, Double Ixora species and *Gardenia* species were planted in a completely randomized design on 10 x 8 meter plot at the senior staff quarters CRIN Headquarters, Ibadan. This plot was established in May 22, 2009 while water was supplied through irrigation and other agronomic activities carried out as and when due. Plucked samples of leaf of robusta coffee (*Coffea canephora)*, *Ixora coccinea* (Single red), *Ixora brachypoda* (Double) as well as unvariegated *Gardenia ellis* were dried under shade in the Entomology laboratory at CRIN Headquarters in Ibadan for about a week. These samples were separately ground to powdery form with an electric blender and taken to the National Institute of Science Laboratory Technology Institute, Samonda, and Ibadan for some limited phytochemical analyses to be carried out due to fund constraint.

Results and Discussion: Though these plants are still very young, preliminary observations showed the presence of eggs and all the larval instars of *C. hylas* on the flushes of coffee and *G. ellis* while larval damage was observed on all the other *Ixora* species.
The result of the phytochemical analysis on some elements (Iron, Zinc, Copper and Lead) as well as the caffeine content of four of the plants is presented in Table 1.

Table 1: Results of analysis of selected host plants of *C. hylas*

Plant type	Fe ppm	Zn ppm	Cu ppm	Pb ppm	Caffeine %
Coffee	915.2c	218.1a	223.6b	ND	57.99b
Gardenia	988.9c	310.6b	237.8b	ND	23.5a
I. coccinea	654.5b	322.7b	198.3b	ND	54.7b
I. brachypoda	504.2a	360.4b	164.9a	ND	87.6c

ND = Not Detected

Means followed by the same letter in the same column are not significantly different ($p<0.05$) Tukey's Honestly Significant Difference (HSD).

Summary and Conclusion:

The high caffeine content of *Ixora brachypoda* is a significant pointer that gives credence as to why there was abysmally low insect pest incidence on that plant in the field. This is further corroborated by earlier work of the first author. While this work is still on-going, further analysis of the content of some other plant elements will help to determine the plant that would be most appropriate for use as trap plant of this obnoxious pest of robusta coffee.

Outlook: On-going

References:

Okelana, F. A. (2000). Bioecology and control of the Oriental bee-hawk moth, *Cephonodes hylas* Linnaeus (Lepidoptera: Sphingidae) on robusta coffee, *Coffea canephora* Pierre ex. Froehner. *Ph.D. Thesis*, University of Ibadan, Nigeria; 178pp.

Experimental Title: Pesticide residue in insecticide treated coffee beans and soil. (Aikpokpodion P.E. and Anikwe J.C.)

Objective: To determine the residue of Endosulfan in coffee, soil and residual effects on soil microflora and microfauna.

Justification: Intensive agricultural practices often include the use of pesticides to enhance crop yields. However the improvement in yield is sometimes concomitant with the occurrence and persistence of pesticide residues in soil and water (Ware and Whitacre 2004). Endosulfan is used worldwide in the control of coffee stem borer. Endosulfan (1,2,3,4,7,7-hexachlorobicyclo-2,2,1-heptene-2,3-bis-hydroxy methane-5,6 sulfite) is a broad spectrum cyclodiene insecticide. It is used extensively throughout the world to control the insect pests of a wide range of crops including cereals, tea, coffee, cotton, fruits, oil seeds and vegetables. It is used in the control of coffee stem borer. The technical endosulfan is a mixture of two stereoisomers2, i.e. alpha- and beta-endosulfan in the ratio of 7: 3. Endosulfan is of great concern because of its persistence and extreme toxicity to fish and aquatic invertebrates. Endosulfan has been classified as a moderately hazardous chemical5. Owing to its extensive usage, Endosulfan residues are commonly found in the environment. Liess (2004), reported that, many pesticides have toxic effects that are not confined to their target species, and their application may have impacts on organisms that benefits the wider agro ecosystem. Some of these pesticides persist in the soil for a very long period and exert adverse effects on the soil Organisms. Most farmers are only interested in getting high yield of farm produce at the time of harvest but care less about the soil environment which is the habitat of diverse array of microorganisms. It has been reported that only 5% of appled pesticide gets to the plant while the remaining 95% is distributed

between the air and soil (Leonilla, 2002). It is therefore necessary to examine the residue of endosulfan that is absorbed into coffee seeds during pesticide application and the impact of endosulfan on non-targeted beneficial biota in the soil.

Materials and Methods

Endosulfan 35EC was applied to selected coffee stands at the Kusuku station of the Institute twice in the year 2009 at three rates. Pre- treatment soil and plant samples were taken before pesticide application. Coffee seeds and soil sample were collected at the time of harvest ready for pesticide residue analysis.

Outlook: The experiment continues in 2010.

Experimental Title: Genotype X environment on the yield of selected clones of *Coffea canephora (*Dada K.E, Omolaja S.S, Adeyemi E.A and Oloyede A.A)

Objective: To determine the genetic stability of the different clonal materials in the coffee seed garden with respect to yield.

Methodology: The selected clones were established in coffee seed garden plot located at zone 1 at CRIN headquarter in 2003.The clones planted are C111, C36 (Quillou) and T1049 (Java). Each of the clones was planted in rows in augmented design in 2 replicates. Berries were harvested between Septembers – December every year between years 2006-2008. The average berries yield for the genotype was subjected to statistical analysis.

Result and Discussion: The three clones average yield range for C111, C36 and T1049 were (1.22-1.55 kg), (1.01-1.42 kg) and (1.04-1.50kg) respectively. The analysis of variance (AOV) for the clones (Genotype) across the year as shown in table 2 shows that the effect of genotype on the yield is highly significant at p<0.01).However, Genotype X Year is not significant at p <0.01 . This is as a result of the genetic stability of the selected varieties across the year.

Table 1: Yield output for the selected clones

	Rep 1			Rep 2		
	2006 kg	2007 kg	2008 kg	2006 kg	2007 kg	2008 kg
C111	1.22	1.40	1.42	1.30	1.55	1.50
C36	1.01	1.05	1.33	1.08	1.10	1.42
T1049	1.04	1.25	1.40	1.28	1.40	1.50

Table 2: Analysis of Variance for yield in the selected clones

Source	DF	SS	MS	Fcal
Genotype (clones)	2	0.168	0.084	9.33 **
Year	2	0.225	0.113	12.56 **
Error	8	0.062	0.09	
				P<0.01

Conclusion: The variation in climate from 2006 to 2008 did not have any significant effect on the yield of coffee clones planted in the seed garden.

Constraints: Labour

Outlook: Ongoing

Experimental Title: Influence of arbuscular mycorrhizal inoculation and phosphate fertilizer types on the growth of coffee seedlings in two soil types in Nigeria. (Ibiremo, O.S., Daniel, M.A, Oloyede, A.A and Iremiren, G.O.)

Objective: To evaluate the effect of phosphate fertilizer types and Arbuscular

Mycorrhizal fungi inoculation (AMF) on the growth of coffee seedlings in two soil types in Nigeria.

Methodology: The trial was a factorial experiment involving two types of P-fertilizers (Single Super Phosphate and Sokoto Rock Phosphate) and AMF inoculation. The P-fertilizers were applied at 30kg $P_2 0_5$/ha and a control (no-P fertilizer application) while the AMF was applied at two levels (with and without inoculation). The six treatments combinations were applied to two-month old coffee seedlings grown in the two soils (Ibadan and Mambilla). The experiments were laid out in a CRD with three replications and data on growth of coffee and soil parameters were taken for six months.

Results: In Mambilla soil, the height and stem diameter of coffee seedlings were significantly ($P< 0.05$) higher as a result of application of SSP and AMF inoculation compared with SRP and AMF inoculation or the control. The number of leaves and leaf area were significantly ($P< 0.05$) improved due to application of SSP and SRP with or without AMF inoculation in Mambilla soil while in Ibadan soil, AMF inoculation resulted in consistent and significant improvement on the stem diameter and leaf area of coffee seedlings. Soil pH and Organic Carbon were not significantly affected by the application of phosphate fertilizer types in both soils. However, the soil available P was significantly ($P< 0.05$) enhanced in the two soils due to application of SSP with or without AMF inoculation. Similarly, the root colonization of coffee seedlings at 6 MAT was significantly higher as a result of AMF inoculation without P-fertilizer application compared with root colonization under SSP application and AMF inoculation in Mambilla soil. The AMF inoculation with or without Phosphate fertilizer did not significantly affect the colonization of coffee seedling roots in Ibadan soil. SRP had a comparable effect with SSP on the growth of coffee seedlings especially under AMF inoculation hence, SRP is a promising substitute for inorganic phosphate sources for coffee seedling production in Nigeria.

Conclusion: SRP had a comparable effect with SSP on the growth of coffee seedlings especially under AMF inoculation; hence, SRP is a promising substitute for inorganic phosphate sources for coffee seedling production in Nigeria.

Constraints: Fund will be required to complete the nutrient analysis.

Outlook: The experiment will be done in the field in year 2011

Table 1: Some physical and chemical characteristic of soils of Ibadan and Mambilla.

Soil properties	Ibadan value	Mambilla value
Physical properties		
Sand g/kg	892.00	500.00
Silt g/kg	143.00	160.00
Clay g/kg	165.00	340.00
Texture	sandy clayey loam	clayey loam
Chemical properties		
PH (H_20)	5.90	5.60
Organic Carbon g/kg	9.80	26.0
Total N	2.00	1.70
Available P mg/kg	20.00	2.15
Exchangeable cations		
K cmol/kg	0.50	6.60
Ca cmol/kg	10.00	2.41
Mg cmol/kg	2.00	0.59
EA	nd	0.58
Cn	nd	0.82
Mn	nd	86.3
Zn	nd	7.16

Table 2: Influence of phosphate fertilizers and Arbuscular Mycorrhizal inoculation on the growth of coffee seedlings in Mambilla soil.

Treatments	Plant Height (cm)			Stem Diameter (cm)			Number of Leaves			Leaf Area (cm²)		
	2 4 6 Months after Transplanting			2 4 6 Months after Transplanting			2 4 6 Months after Transplanting			2 4 6 Months after Transplanting		
P_1m_0	9.05^{e}	13.30^{de}	18.67^{a}	0.23^{e}	0.32^{de}	0.46^{a}	7.50^{c}	10.00^{c}	14.50^{b}	8.46^{b}	15.07^{a}	25.74^{a}
P_1m_1	15.23^{b}	17.65^{a}	17.25^{a}	0.22^{e}	0.33^{d}	0.40^{ab}	7.00^{c}	9.00^{c}	12.00^{b}	5.18^{c}	5.94^{c}	2.89^{b}
P^2m_0	9.90^{e}	12.90^{de}	15.24^{ab}	0.24^{e}	0.27^{e}	0.34^{de}	7.33^{c}	10.50^{c}	11.95^{b}	9.79^{b}	15.03^{a}	22.11^{a}
P_2m_1	10.80^{de}	11.35^{e}	10.70^{e}	0.25^{e}	0.28^{e}	0.26^{e}	8.00^{c}	9.00^{c}	11.00^{b}	6.29^{bc}	5.48^{c}	4.05^{b}
P_0m_0	9.37^{e}	10.15^{e}	10.70^{e}	0.23^{e}	0.22^{e}	0.22^{de}	6.25^{c}	6.00^{c}	7.50^{bc}	5.07^{c}	5.63^{c}	3.73^{b}
P_0m_1	10.20^{e}	12.69^{de}	15.71^{ab}	0.22^{e}	0.25^{e}	0.32^{de}	7.17^{c}	8.83^{c}	11.75^{b}	8.96^{b}	17.84^{a}	24.42^{a}

For each location means in columns followed by the same letter(s) are not significantly different by Duncan's Multiple Range Test at ($P < 0.05$). M = with mycorrhiza inoculation, NM = without mycorrhiza inoculation, ns = not significant. P_O = no P, P_1 =SSP, P_2 =SR

Table 3: Influence of phosphate fertilizers and Arbuscular Mycorrhizal inoculation on the growth of coffee seedlings in Ibadan soil.

Treatments	Plant Height (cm)			Stem Diameter (cm)			Number of Leaves			Leaf Area (cm²)		
	2 4 6 Months after Transplanting			2 4 6 Months after Transplanting			2 4 6 Months after Transplanting			2 4 6 Months after Transplanting		
P_1m_0	11.03^{a}	12.62^{a}	14.07^{a}	0.25^{a}	0.25^{a}	0.30^{a}	11.00^{a}	12.00^{a}	12.00^{a}	4.05^{a}	4.54^{a}	4.68^{a}
P_1m_1	11.10^{a}	11.50^{a}	12.50^{a}	0.30^{a}	0.30^{a}	0.30^{a}	10.00^{a}	10.00^{a}	12.00^{a}	4.75^{a}	5.40^{a}	5.50^{a}
P^2m_0	11.75^{a}	12.50^{a}	13.50^{a}	0.35^{a}	0.35^{a}	0.36^{a}	8.00^{a}	8.00^{a}	12.00^{a}	6.00^{a}	6.44^{a}	6.54^{a}
P_2m_1	11.60^{a}	12.00^{a}	12.50^{a}	0.30^{a}	0.31^{a}	0.31^{a}	8.00^{a}	10.00^{a}	10.00^{a}	6.91^{a}	6.09^{a}	6.70^{a}
P_0m_0	11.50^{a}	12.05^{a}	13.05^{a}	0.25^{a}	0.25^{a}	0.26^{a}	10.00^{a}	10.00^{a}	13.50^{a}	4.37^{a}	4.74^{a}	4.93^{a}
P_0m_1	11.50^{a}	13.00^{a}	14.00^{a}	0.24^{a}	0.30^{a}	0.35^{a}	10.00^{a}	12.00^{a}	13.00^{a}	10.89^{a}	10.69^{a}	15.05^{a}

For each location means in columns followed by the same letter(s) are not significantly different by Duncan's Multiple Range Test at ($P < 0.05$). M = with mycorrhiza inoculation, NM = without mycorrhiza inoculation, ns = not significant. P_O = no P, P_1 =SSP, P_2 =SRP

Table 4: Soil chemical properties and root infection as influenced by phosphate fertilizer application to AMF inoculated coffee seedlings in Ibadan and Mambilla soils.

Treatments	pH		OC		Avail p		Myco infection	
	Ibadan	Mambilla	Ibadan	Mambilla	Ibadan	Mambilla	Ibadan	Mambilla
P_1m_0	5.75^{b}	6.40^{a}	5.62^{a}	2.72^{a}	6.18^{ab}	10.80^{a}	66.95^{a}	66.50^{b}
P_1m_1	6.00^{b}	5.80^{a}	5.50^{a}	4.22^{a}	8.91^{a}	1.47^{d}	70.90^{a}	45.00^{c}
P^2m_0	5.80^{b}	6.50^{a}	5.54^{a}	3.17^{a}	4.36^{b}	6.62^{b}	68.55^{a}	66.35^{b}
P_2m_1	5.70^{b}	5.70^{a}	5.50^{a}	4.74^{a}	5.61^{ab}	4.98^{c}	68.50^{a}	77.50^{ab}
P_0m_0	5.85^{b}	6.40^{a}	5.15^{a}	3.26^{a}	5.38^{ab}	6.79^{b}	45.30^{a}	62.55^{b}
P_0m_1	6.70^{a}	5.90^{a}	5.35^{a}	4.66^{a}	4.36^{b}	9.18^{a}	70.00^{a}	89.50^{a}

For each location means in columns followed by the same letter(s) are not significantly different by Duncan's Multiple Range Test at ($P < 0.05$). M = with mycorrhiza inoculation, NM = without mycorrhiza inoculation, ns = not significant P_O = no P, P_1 =SSP, P_2 =SRP

KOLA PROGRAMME

Experimental Title: Response of kola seedlings to depleted soils amended with organic fertilizers. **(**Ogunlade, M.O, Adebowale L.A and Ipinmoroti R.R)

Introduction

Raising of vigorous kola seedlings in the nursery is necessary for good seedling establishment on the field. At present obtaining forest top soil for raising crop seedlings have become difficult and forest top soil had to be purchased at high cost. This is the situation with many organization involved in raising the tree crop seedlings for commercial purpose. Therefore, the main objective of this work is to raise kola seedlings with sub (nutrient depleted) soils amended with organic fertilizers, such as kola pod husks and poultry droppings.

Methodology:

Sub- soil samples were collected at 30-60cm soil depth. The soil samples were bulked, air dried, mixed together and sieved to pass

through 2mm sieve. Top soil was also collected at 0-30cm and processed as done with sub soil. The physical and chemical properties of the soil were determined in the laboratory. Kola pod husks were collected, dried and milled using the hammer milling machine. Poultry droppings were also collected for use in this experiment. The major nutrient contents N, P, K, Ca and Mg of the organic materials- Kola Pod Husks (KPH) and Poultry Droppings (PD) were determined in the laboratory.

There were six treatments: Top soil alone, Subsoil alone, Subsoil+KPH (2.5tons/ha), Sub soil+KPH (5tons/ha), Sub-soil +PD (2.5tons/ha), Subsoil+PD (5tons/ha). The treatments were imposed at planting. It was a completely randomized design with four replications. Watering was done twice per week. Growth parameters were taken monthly throughout the period of the study. The dry matter yield was determined six months after treatment applications. Data were subjected to analysis of variance and means found significant were separated using Duncan multiple range test at P< 0.05

Results and Discussion

The chemical properties of the soil (Table 1) indicated that the top soil(0-20cm) is more fertile than the sub soil(20-40cm) considering organic carbon, total N, exchangeable K and available P. Clay content is higher in the sub soil than the top soils.

Table 1: Some physical and chemical properties of the soils used

Properties	Soil depth	
	0-20cm	20-40cm
Ph	6.5	6.0
Organic carbon(g/kg)	10.2	7.5
Total nitrogen (g/kg)	0.21	0.11
Available P(mg/kg)	8.6	4.2
Exchangeable K(cmol/kg)	0.31	0.12
Exchangeable Ca(cmol/kg)	3.14	2.04
Exchangeable Mg(cmol/kg)	0.42	0.33
Sand (g/kg)	686	704
Silt(g/kg)	150	72
Clay(g/kg)	164	224

At 2 months after treatment application, there was no significant difference between kola seedling height under unamended top soil and sub soil amended with organic fertilizer. Sub soil amended with 5tons/ha of either KPH or poultry droppings consistently gave higher seedling height than amendment with 2.5tons/ha at 6MAP, but significantly lower than unamended top soil.

Table 2: Effect of amended and unamended soil on height of kola seedlings

Treatments	2MAP	4MAP	6MAP
Top soil	48.7a	64.5a	69.3a
Sub soil	35.7b	41.9b	45.6b
Sub soil+2.5tons/ha KPH	43.0ab	48.3b	50.2b
Subsoil+5tons/haKPH	44.6ab	50.7b	53.5b
Sub soil+2.5tons/ha PD	39.5ab	43.4b	45.0b
Sub soil+5tons/ha PD	41.3ab	50.7b	53.2b

Means followed by same letters are not significantly different at P<0.05

KPH : Kola Pod Husk, PD :Poultry Droppings

Stem diameter of kola seedlings under unamended top soil and amended subsoil with 5tons/ha of PD were not significantly different at 4th and 6th month after treatment application (Table 3).

Table 3: Effect of amended and unamended soil on stem girth of kola seedlings

Treatments	2MAP	4MAP	6MAP
Top soil	0.78	0.83a	1a
Sub soil	0.70	0.72b	0.78b
Sub soil+2.5tons/ha KPH	0.73	0.78ab	0.93ab
Subsoil+5tons/haKPH	0.65	0.80ab	0.90ab
Sub soil+2.5tons/ha PD	0.68	0.78ab	0.88ab
Sub soil+5tons/ha PD	0.75	0.85a	0.95a
	NS		

Means followed by same letters are not significantly different at P<0.05

KPH : Kola Pod Husk, PD :Poultry Droppings.

Kola seedling leaves produced in unamended top soil were not significantly different from the number of leaves of kola seedling under subsoil amended with 5tons/ha of KPH and PD (Table4). It implies that in the absence of

top soil, sub soil could be amended with 5 tons/ha of PD or KPH.

Table 4: Effect of amended and unamended soil on number of leaves of kola seedlings

Treatments	2MAP	4MAP	6MAP
Top soil	15a	25a	33a
Sub soil	10a	12ab	16b
Sub soil+2.5tons/ha KPH	14a	18ab	21b
Subsoil+5tons/haKPH	15a	18ab	22ab
Sub soil+2.5tons/ha PD	12a	17ab	21b
Sub soil+5tons/ha PD	15a	20ab	22ab

Means followed by same letters are not significantly different at P<0.05
KPH : Kola Pod Husk, PD :Poultry Droppings.

Stem and total dry matter yield of kola seedlings grown on unamended top soil and subsoil amended with 5tons/ha of PD There were significant differences (Table 5). This suggests that subsoil amended with 5tons/ha of PD can be used where there is dearth of forest top soil.

Table 5: Effects of amended and unamended depleted soil on dry matter yield (DMY) of kola seedlings

Treatments	Leaf DMY	Stem DMY	Root DMY	Total DMY
Top soil	15.9a	11.0a	9.3	36.1a
Sub soil	5.4c	5.1c	6.8	17.2c
Sub soil+2.5tons/ha KPH	7.9bc	5.9bc	9.7	23.5bc
Subsoil+5tons/haKPH	9.4b	6.8bc	7.5	23.7bc
Sub soil+2.5tons/ha PD	9.3b	5.5c	6.7	21.5bc
Sub soil+5tons/ha PD	10.2b	8.9ab	10.3	29.3ab
		NS		

Means followed by same letters are not significantly different at P<0.05
KPH : Kola Pod Husk, PD :Poultry Droppings

Conclusion: In locations where there is little or no forest top soils for raising seedlings, sub soil can be amended with organic fertilizers such as poultry droppings and kola pod husks and used for raising vigorous kola seedlings

TEA PROGRAMME

Experimental Title: Tea establishment in Ibadan for lowland tea studies. (Daniel.M.A Oloyede.A.A., Famaye .A.O. and Ipinmoroti.R.R.)

Objectives: To establish a model tea plot at Ibadan for further studies on lowland areas.

Introduction: Tea is a beverage crop of health importance. The fixed landed areas for commercial tea cultivation expansion on the Mambilla Plateau to increase tea production calls for introduction of tea cultivation to the lowland areas of Nigeria. Over the years, adaptive trials efforts by past scientists have shown that, areas like Ikom, Ikorodu, Ibadan, Iyanomo, Akwete and Ijebu Ife have been planted to tea but abandoned. Hence, there is need to establish tea plot to point at which could serve as a reference plot for tea research in the lowland areas to arouse the interest of local and international would be farmers that could go into tea cultivation in the listed localities except Ikom. Therefore, the establishment of a model tea plot at Ibadan would go a long way in solving the above mentioned and would serve as close experimental site for majority of scientists on tea progamme at the Headquarters.

Methodology

A two hectare of land located at Zone 9 of the Institute was selected for tea establishment. The land was cleared and plantain suckers were planted at 3 by 3m spacing .Pegging at 1 by 0.6m spacing for tea seedlings planting was carried out. A total of 200 tea seedlings were transported from Kusuku – CRIN Mambilla station to CRIN Headquarters in July 2009 and were transplanted at the 2ha plot. Watering started in November (twice weekly) and mulching was done in January.

Results

The selected area was cleared and plantain suckers were transplanted. The plot were pegged (1 by 0.6m),holed (Fig.1) and two hundred rooted tea seedlings comprising of four different clones were transplanted in July (Fig 2). Mulching and watering started in November (twice a week).At the end of March, about 85% of the tea seedlings survived under plantain shade. Termite infestation was prevalent eating up the mulched grass materials and sometimes the tea seedling stem

Conclusion

Tea seedlings can equally do well in the lowland areas, but there is need for irrigation due the high rate of the evapotranspiration especially during the dry season coupled with termite infestation and the soil pH control through the use of Al (SO_4). There is need to supply more tea seedlings to gap –up and expand the plot. Similarly, the introduction of fertilizer trials is necessary and other agronomic practices coupled with the farming system during early tea establishment.

Fig.1: Tea seedlings ready for planting and pegging of tea plot in Ibadan

Fig.2: Pegged area for tea seedlings in Ibadan

Fig.3: Transplanting of tea seedlings in Ibadan

Experimental Title: Introduction of establishment of tea to CRIN-Uhonmora station for lowland tea studies. **(**Ipinmoroti.R.R, Daniel.M.A)

Objectives: To expand tea cultivation to lowland areas for further studies across ecological zones.

Introduction: Tea is a notable beverage crop of health importance that is cheap and affordable to all. More than 80% of the total tea consumption in Nigeria is through importation while less than 20% is produced locally. This trend is costing Nigeria a very large amount of foreign exchange deficit. The stems from fixed land areas for tea field cultivation in commercial tea cultivation areas on the Mambilla Plateau. To increase tea production through land areas calls for

introduction of tea cultivation to the lowland areas of Nigeria, especially the southern ecological agricultural area. The better performance of tea already introduced to CRIN Uhonmora calls for further studies.

Methodology.
A two hectare of land was prepared and plantain suckers were planted at 3 by 3m spacing and strip portion of 10 by 30m was air – marked and pegged at 1 by 0.6m spacing for tea seedlings planting. A total of one hundred tea seedlings were transported from Kusuku – CRIN Mambilla station to CRIN Uhonmora station in July 2009 and were transplanted to the mapped portion of the 2ha plot. The watering started in November (twice weekly) and mulching with palm front in January.

Results
That, about 75% of the tea seedlings survived after transplanting due to the inclusion of palm frond round the seedlings as shade in addition to plantain shade increase the survival of the tea seedlings. This study has made students from various institutions gain from the plot on various agronomic practices carried out especially on tea just introduced. Local farmers in the area have shown keen interest on tea cultivation which is new in the area.

.**Future focus;**
Focus ahould be on the need to supply more tea seedlings to gap –up and expand the plot with different tea clones. Also, introduction of fertilizer trials with pressurized irrigation and other agronomic practices coupled with the farming should be encouraged.

Experimental Title: Preliminary report on the identification, collection and determination of pest status of insects on lowland tea.*(Asogwa, E.U.; J.C. Anikwe; I.U. Mokwunye and F.A. Okelana)*

Objective:
The objective of the study is to document the insect complex of tea as well as to determine their pest status**.**

Introduction
Till date, insect pest of tea have not been well classified and documented.This study was aimed to provide baseline information on the major and minor insect pest of tea, which is necessary for the development of an ecologically sound control measures for the pests.

Methodology:

a. Rehabilitation of the tea plot: The tea plot at Ajassor has not been maintained for years and has been overgrown by bush (Plate 1). The surviving tea stands were already overgrown (about 5.6 feet tall) (Plate 3). The plots were therefore cleared and the tea stands coppiced at 90cm from the ground level

Plate 1: Tea observation plot overtaken by bush

Plate 2: Clearing of the tea plot

Plate 3: Over grown tea bush

Plate 4: Prunning of tea bush

Plate 5: Prunned tea bushes

b. Assessment of pest incidence on the new flushes: The regenerated flushes from the established tea clones was assessed for the level of insect pest occurrence and damage. Damage estimates was made on a five-point scale including:

0	-	No damage
1	-	¼ damage
2	-	½ damage
3	-	¾ damage
4	-	Severe damage

Branches and pluckable flushes was assessed for pest infestation and damage from five branches, which was randomly selected per clone. Data collected was subjected to appropriate statistical analysis.

c. Collection of insect pest samples: Prevalent insect pest on the tea flushes and surroundings was collected directly by hand or with sweep nets for the purpose of identification.

d. Identification of the pests collected from the plot: The insect pests collected were gently knocked-off in a kilnerjar bottle stocked at the base with a cotton wool containing ethyl acetate. The various insects were taken to our insect museum, where they were processed and properly identified.

Results

Partial rehabilitation of the plot at Ajassor has been achieved. The plot is now ready for the commencement of actual assessment of the lowland tea pest status.

Conclusion

The plot will be revisted for actual assessment of the pest status.

EXTENSION PROGRAMME

Experimental Title: Constraints of Farmers in cashew production: A case study of Orire L.G.A of Oyo State, Nigeria. (Uwagboe, E.O., Agbongiarhouyi, A.E, Adebiyi, S. Ndagi, I. and Aigbekaen, E.O)

Introduction

Various constraints are militating against the production, marketing and processing of cashew in Nigeria. Ayodele (1999) identified the following constraints of cashew in Nigeria; land acquisition (about 60% of Nigeria cashew nut production is attributed to small-scale farmers who manage between 2 and 4ha of cashew farm), unavailability of labour, lack of processing technology, high cost of production, unstable market system, high interest rate, low funding, inadequate infrastructural facilities such as rural roads, electricity, water supply and poor extension services.

However, recent studies have identified various constraints militating against cashew fruits production which varies from one place to the other. Hence, the need to examine the constraints of cashew production among farmers in Orire L.G.A.of Oyo state which is the main objective of this study.

Objectives of the study:

1. To identify the socio-economic characteristics of the respondents in the study area
2. To examine the farming activities of the respondents in the study area and,
3. To examine the constraints of cashew fruits production in the study area.

Methodology

Purposive sampling technique was used to select Orire block as a major cashew producing area in Ogbomoso zone of the Oyo State. Five villages namely: Iluju, Ahoro, Oko, Egbejoda and Ahoro Dada were selected from the fourteen cashew producing villages identified in the area with simple random sampling technique. Detailed questionnaires were administered to one hundred and ten respondents on proportional basis using systematic sampling technique with the list of ADP contact farmers. Data were analysed using frequency counts, percentages and Pearson Product Moment Correlation (PPMC) with SPSS 11.0 Windows.

Results and Discussion

Selected personal characteristics

The selected personal characteristics of the farmers are presented under the following sub-headings: Age distribution of the respondents, Sex and educational level.

Age is an important factor in farm work. Increase in number of years of farming might result in additional experience of the farmer, to improve upon their level of productivity and income. The result on Table 1 shows that most (52.70%) of the respondents were between the age range of 30 and 49 years, 44.60% were above 50 years while 2.70% are less than 30 years. This implies that most of the cashew farmers in the study area were in their prime age and could be vulnerable to rural-urban drift in search for white collar jobs which can adversely affect cashew production.

Cashew farming requires labour, which is also gender sensitive. Table 1 shows that most (84.50%) of the cashew farmers are males while 15.50% are females. The male domination of cashew farming activities as observed in the study area could be attributed to the fact that women are given opportunity to cultivate arable crops on the their husband's plots while access to permanent crop production is usually restricted to men (Abubakar, 2003)

It is generally believed that farmer's level of education would enhance their farming activities and level of awareness. Most (57.30%) of the respondents have no formal education while (28.2%) had primary education only few (10.00%) and (4.50%) of the respondents have secondary and tertiary education respectively (Table 1), which is an indication that the farmers level of education in the study area is very low which could affect

their level of receptivity of improved technologies. Poor adoption of improved technologies could reduce their yield and consequently result in low income of the farmers.

Farming Activities:

As indicated in Figure. 1, most (65.50%) of the respondents cultivated less than 6ha of farm land. It also shows that 25.50% of the respondents cultivated between 6 and 9.99ha while 9.00% cultivated 10ha and above. It can also be deduced from the finding that majority of the respondents are small scale farmers cultivating less than 6ha which is in agreement with Olayide (1980) findings that majority of farmers in Nigeria are small scale farmers as they cultivate less than 10ha. of farm land. This could be due to problems such as inadequate access to natural resources including land, capital, composite farm policy of the government, inefficient system e.t.c (Akinwale and Ayodele, 1999).

Varieties of Cashew Used for Planting

Table 2 reveals that most (80.90%) of the cashew farmers used local varieties (Ogbomoso varieties) which could result to smaller nuts and low income, as their produce could not meet up with the required standard grade for export. Olunloyo (1996) reported that the large size of nuts are more acceptable for export. Therefore the numbers of nuts for each 1kg should not count more than 160-200 nuts. Any sample collected which counts more than this limit per kg will attract lesser price while counting below 160 normally attract additional price. However, few (9.10%) and 10.00% used CRIN improved varieties and Brazilian Jumbo nuts respectively. This is an indication that majority of the cashew farmers do not use improved varieties and this results in poor yield and will affect their income.

Constraints experienced by cashew farmers

Table 3 reveals that most (70%) of the respondents ranked inadequate capital as the most severe constraints while lack of storage facilities was ranked by few (5.5%) of the respondents as serious constraints. This implies that cashew farmers in the study area could have found it difficult to obtain loan from banks that will require collateral to enhance increase in their cashew production which would increase their level of income. Storage facilities as the least constraints could be attributed to the fact that the cashew farmers do not store their produce as they sell most of their produce fresh and do not process. Akinwale *et al* (2001) observed that despite the increase in cashew production in Nigeria, it is only the cashew nuts that are being utilized in the processing industry.

Effect of constraints on cashew farmers' income

The result of the analysis shows that constraints experienced by cashew farmers in the study area negatively affect the income generated from cashew fruits (r=-0.177, P=0.051).This shows that there is a significant relationship between constraints and income generated by farmers. It implies that a significant increase in constraints will lead to reduction in income of cashew farmers (Table 4).

Tables and Figures

Table1: Distribution of respondents by their personal characteristics

Variables	Frequency	Percentage
Age group		
< 30 years	3	2.70
30-49	58	52.70
>50	49	44.60
Total	**110**	**100.00**
Sex		
Male	93	84.50
Female	17	15.50
Total	**110**	**100.00**
Level of education		
No formal education	53	57.30
Primary	41	28.20
Secondary	11	10.00
Tertiary	5	4.50
Total	**110**	**100.00**

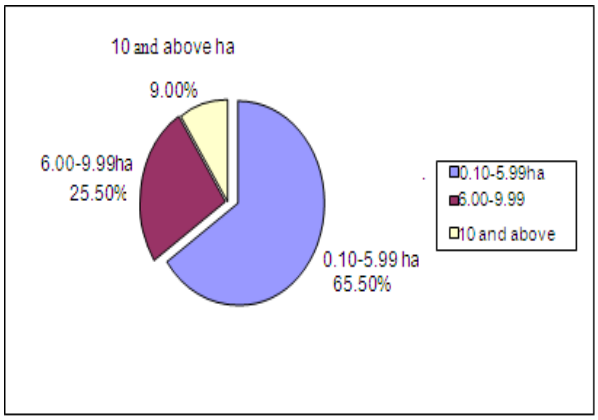

Figure 1: Distribution of respondents farm size
Source: Field survey, 2006

Table 2: Distribution of respondents based on varieties used for planting

Varieties	Frequency	Percentage
Local varieties	89	80.90
CRIN improved varieties	10	9.10
Brazilian Jumbo nuts	11	10.00
Total	110	100.00

Table 3: Ranking of respondents constraints according to their severity

Constraints	Frequency	Percentages	Mean scores	Ranking
Insufficient price information	25	22.70	210	6th
High cost of transport	23	20.90	209	7th
Low farm gate price	30	27.30	225	3rd
Inadequate Extension services	8	7.30	151	10th
Insufficient labour	26	23.60	212	5th
Poor marketing channel	30	27.30	225	3rd
Inadequate market information	20	18.20	185	9th
Poor quality nuts	6	5.50	104	12th
Lack of storage facilities	22	20.00	193	8th
Lack of processing industries	73	66.40	273	2nd
Lack of good access road	28	25.50	217	4th
Insufficient buyers	7	6.40	139	11th
Inadequate capital(Finance)	77	70.00	287	1st

Table 4: Correlation between respondents income and constraints

Variables	r	p	Remark
Constraints and income	-0.177	0.051	S

Level of significance 0.05

Conclusion and Recommendation

Cashew production in Orire LGA of Oyo state is male dominated (84.5%) of the farmers are males. The cashew farmers are relatively young with low level of education. There is inadequate capital (finance) that can be used to expand their farm land as 65.5% of the respondents cultivate 0.10 and 5.99 ha which is too small for commercially sized farm. Majority of the farmers are using unimproved varieties in their farms as planting materials in the establishment of new farms. Other problems of importance are insufficient price information, high cost of transport, low farm gate price, insufficient labour, lack of processing industries and lack of good roads.

These problems can be ameliorated by formulating and implementing economic policies aimed at increasing the level of education which could increase their level of receptivity of improved technologies of cashew production. Government should provide soft loans to the cashew farmers to enable them establish cottage industries in order to alleviate the constraints of inadequate

capital (finance) and lack of processing industries. There should be a collaborative work between CRIN and ADP to enhance awareness creation and easy access to adequate information such as recommended use of improved varieties by cashew farmers in the study area.

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Experimental Title: Assessment of intercropping pattern among kola farmers in Osun State. (Agbongiarhuoyi A.E., Uwagboe, E..O., Adebiyi, S. Ndagi, I. and Aigbekaen E.O**)**

Introduction:

Kola is a tree of commerce, which has two main species: *Cola nitida (L)* '*Gbanja* or *Goro'* and *Cola acuminata (L)* '*Abata'* of Sterculiceae family. *Cola nitida* has normally two to three cotyledons while *Cola acuminata* pocesses three to five or six cotyledons (Opeke, 1992). Kola is native to West Africa particularly Nigeria, Ghana, Cote d' Ivoire and Liberia. Nigeria produces about 70% of world production of kolanuts, which is a major produce from kola tree (Okunade, 2003 and Opeke, 2005). *C. nitida* is the most popular species cultivated to a large degree in Nigeria. It has an annual production of about 300,000 tons with caffeine content of 2.5% (Rehm and Espig, 1991). Kolanut is cultivated in the rain-forest zones of the south Oyo, Ogun, Ondo, Ekiti, Lagos and Osun States and the riverine areas of Kwara state in the savanna region of Nigeria (Ndubuaku, 1989). The most common tradition in African cropping systems is the spatial arrangement of crops on the field. The crops are established haphazardly in mixed culture (Ecological Agriculture projects, 1997). In most farms of kola, it is grown in mixture of other crops by farmers. These cut across arable and tree crops. There are problem of finding ideal crop mixtures that are compatible with one another and achieve maximum yield. Though, intercropping provides food and income in the waiting period for kola to fruit, care needs to be taken to intercrop plants that do not encourage pests and diseases build up as well as suppress weeds. Intercropping is the space dependent form of multiple cropping. Kolanut is chewed to keep people awake during long journey especially truck drivers. It features prominently in religious, social and ritual activities. Kolanuts are offered to visitors as a sign of welcome and appreciation. Medicinally in the traditional circle, the leaves, twigs, flowers, fruits follicles, and the

bark of both *C. nitida* and *C. acuminata* were used to prepare a tonic as a remedy for dysentery, coughs, diarrhea, vomiting and chest complaints (Irvine, 1961; Ayensu, 1978).

Objective:

The major objective is to assess the type of intercropping pattern practiced by kola farmers in the study area. The specific objectives are to:

1. To determine kola farmers selected socio-economic characteristics;
2. To ascertain the arable and tree crops intercropped with kola;
3. To describe the intercropping pattern used by farmers in kola farms.

Methodology:

The study was carried out in Atakumosa West and Orolu Local Government areas (LGAs) of Osun State. The multi- stage sampling procedure was used to select the samples for the study. Osun State has three ADP agricultural zones. These are Iwo, Ife/Ijesha and Osogbo. Two ADP zone: Ife/Ijesha, which cover Atakumosa West, and Osogbo which covers Orolu LGAs, were purposively selected due to their predominance in kola production. In each LGA that constitute a block, two communities each were further selected. They are Oke-Bode and Kajola in Atakumosa West and Egan-Aje and Okiti in Orolu LGAs. In the next stage, a total of 60 respondents were randomly interviewed using structured questionnaire, 15 from each community. The respondents were kola farmers. Frequency distribution was used to describe the socio-economic characteristics of respondents as well as the intercropping combinations, pattern, spacing and sources of information on kola.

Result and Discussion

Socio-economic characteristics of respondents

Table 1 shows the descriptive analysis of respondents' socio-economic characteristics investigated in the study. The study revealed that males (76.7%) dominated kola production while females were 23.3%. Many (65%) of the farmers were above 50 years of age. This means that many of the respondents were within less economically active age. Majority (98.3%) of the respondents were married and 40% of them did not have formal education while others got some form of formal education which could assist them in intercropping practices. A reasonable proportion of the farming experience of respondents was between 12-25 years representing 36.7% indicating likely long years of growing kola with other crops. However, 38.3% of the farmers' farm sizes were between 1-2 hectares of kola farms.

Kola Arable Intercropping Combinations

Table 2 shows that plantain/banana and yam (55%) each, and cassava (53.3%), were more intercropped with kola before fruiting. Other crops such as Maize (36.7%), cocoyam (28.3%) and pineapple were also planted. It means that these crops were commonly used as intercrops in kola farms. A work by World Cocoa Foundation in 2007 on agro-forestry showed that farmers intercrop most of these crops in combination with kola to enhance early returns and income.

Kola and other Tree Crops

The findings in Table 3, showed that cocoa and citrus (88.3%) each, and oil palm (73.3%) were the main tree crops grown with kola among other tree crops. It therefore implies that farmers combine cocoa, citrus and oil palm with kola in the study area. This is similar to the report of (Tachie-Obeng and Brown, 2001) that traditional farmers in West and Central Africa frequently inter-plant food crops and other tree crops like cocoa with kola, but added that the practice was thought to deplete the stored surface soil fertility.

Proportion of Cropping Pattern in Kola Farm of Farmers

In Table 4, majority (70%) of the respondents claimed they did not maintain any proportion of cropping pattern for planting only kola. However, one third (13.3%), one quarter (8.3%) and half hectares (3.3%) had different proportions of cropping pattern. It means that only few respondents planted kola as a sole crop in their farms. Many (58.3%) had some form of cropping proportions of 1/3, 1/4, ½ and 1hactares for kola and arable crops. A higher figure (55%) was observed between kola and trees crops without cropping pattern proportion. Also (25%) respondents had kola/arable and other tree crops grown in half proportions in their farms while 21.7% planted theirs in one quarter farm. The results indicated that they practiced more of mixed cropping systems of intercropping in kola plots.

Table 1: Socio-economic Characteristics of respondents.

Characteristics	Frequency	Percentage
Sex		
Male	46	76.7
Female	14	23.3
Age (Years)		
= 39	7	11.7
40-49	14	23.3
50-59	17	28.3
= 60	22	36.7
Marital Status		
Married	59	98.3
Single	1	1.7
Educational Status		
No formal education	24	40
Primary education	20	33.3
Secondary education	13	21.7
Tertiary education	3	5.0
Farming Experience (Years)	9	15.0
Less than 12	22	36.7
12-25	14	23.3
26-39	11	18.3
40-53	4	6.6
Greater than 53		
Farm size (ha)	23	38.3
1-2	19	31.7
3-4	8	13.3
5-6	10	16.7
Above 7		

Table 2: Arable crops intercropped with kola

Arable crops	Frequency	Percentage
Plantain/Banana	33	55
Yam	33	55
Cassava	32	53.3
Pineapple	14	23.3
Maize	22	36.7
Cocoyam	17	28.3
Pepper	4	6.7
Melon	4	6.7

Table 3: Tree crops grown with kola

Tree crops	Frequency	Percentage
Cocoa	53	88.3
Citrus	53	88.3
Cashew	9	15
Oil palm	44	73.3
Mango	3	5
Breadfruit	2	3.3
Walnut	2	3.3
Pawpaw	1	1.7
Pear	2	3.3
Guava	1	1.7

Table 4: Proportion of cropping pattern in kola farm

Cropping pattern (ha)	Sole kola	Kola & arable crops	Kola & tree crops	Kola, arable & tree crops
1/3	8(13.3)	13(21.7)	5(8.3)	13(21.7)
1/4	5(8.3)	12(20)	6(10)	11(18.3)
1/2	2(3.3)	6(10)	6(10)	15(25)
1	3(5)	4(6.6)	10(16.7)	11(18.3)
No cropping pattern	42(70)	25(41.7)	33(55)	10(16.7)

Conclusion:

From the study, respondents planted mainly intercrop arable crops such as plantain and banana, yam, cassava, cocoyam with kola at early establishment while some tree crops: cocoa, citrus and oil palm were popularly used as intercrops in kola farms. Majority of the respondents did not maintain definite cropping pattern when kola was planted solely and in combination with other crops. In order to enhance adequate practices of intercropping arable and tree crops with kola, farmers should practice good agricultural practices in their kola farms. This could be

achieved via State Agricultural Development Programmes among farmers.

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Experimental Title: An assessment of gender involvement in kola production in Osun State,
Nigeria **(**Adebiyi, S.and Oluyole, K.A.)

Introduction

Kola, which belongs to the family *Sterculiaceae*, has long history in West Africa, its use features prominently in religious, social and ritual activities of West Africa. They are found relevant in ceremonies related to marriage, child naming, funerals and in consulting various gods and goddess as the case may be. Johannas Leo Africanas was the first person to refer to kola nut in 1556. The Portuguese, Odorado Lapez recorded the occurrence of kola tree in Congo in 1591 followed by Andre Alvares, who saw them in Gambia and Guinea in 1954 (Opeke,1987). Subsequently, the tree was recorded along the West Coast of Africa from Gambia to Angola.

*Cola nitida*_was originally distributed along the West Coast of Africa from Sierra-Leone to the Republic of Benin (Opeke, 1987) with highest frequency and variability in the forest area of Ivory Coast (now Cote d'Ivoire) and Ghana. This area remained for long the only source of kola nuts to the West African trade routes.

The importance of kola nut to Nigerian economy can not be over-emphasized, kola nut as a tropical tree crop has over twenty species, out of these *cola nitida* and *cola acuminata*_are the only species grown on large scale in Nigeria. Out of the two species, *cola nitida* is being traded internationally, while, the consumption of *Cola acuminata* is confined to Southern Nigeria. Before the dependence of the economy on crude oil, the place of kola nut cannot be over-emphasized (Akinbode 1982). Out of the three components of kola fruit (pods) that is kola pod husk, kola testa and nuts, only the nut has been found of high economic use, either in Nigeria or in the developed countries. It was estimated that Nigeria produces about 127500

tons of the fresh nuts annually; representing 70% of the world production (Pala,1976) about 90% of this amount is consumed in Nigeria and some neighboring West African Countries (Van Eijinatten, 1964). It was also estimated that the internal kola nut market in Nigeria worth's about ₦30 million (Pala, 1976). In 1970, kola nut exports fetched ₦126,000 to Nigerian government. Kola pod husk, which has been considered wasted on the farm in the past, has been processed as diet, this ensure 60% replacement of maize in poultry feed formulation. Also, kola testa, which is found in small quantity, has been used in some feed formulation (Hamzat and Jayeola, 2002). This showed that the whole kola fruit has considerable economic uses.

Prior to the colonization of most African countries, tree cropping was mainly undertaken by men folk. But studies, such as Pala (1976) and Mertha (1982) have shown that colonial economy adversely affected traditional pattern of task allocation. These writers noted that the disruption of the pre-colonial division of labour between sexes in the rural communities, as a result of male absenteeism from the countryside. In line with the fact that wage employment draws men away from their own farms, and western education changing men's attitude about agriculture, many women were found doing what was traditionally meant for men. In several parts of sub-Saharan Africa, women undertake up to 70 percent of production, processing, and marketing of agricultural products. In kola production, there are different stages involved; and in each stage both men and women are involved but in some cases in different intensities. This study examines the extent of gender involvement in kola production in the study area.

Methodology

The study was carried out in five Local government areas of Osun State, Nigeria between June and July, 2007. The sampled Local government areas are Ede North, Ife North, Ife South, Iwo and Osogbo. A total of two hundred respondents were randomly selected from the study area at the rate of forty respondents per local government area. Information was collected from the respondents with the aid of structured questionnaires. Questions such as age, educational level, farm ownership pattern, marital status, gender, stages involved in kola nut production as well as the problems encountered in the course of their work were asked. The data obtained from the information collected was analyzed using descriptive statistics.

Results and Discussion

Socio-economic and demographic characteristics of the respondents.

Table 1 showed that 83.6% of the respondents were male while 16.4% were females. This showed that there were more males in the study area than females. The implication of this is that there would be more hands to do tedious operations in kola production. Such tedious operations could include clearing, chemical application as well as harvesting. All these operations require much strength, which could easily be provided by the males. Table 1 also showed that 75.4% of the total respondents acquired their farmland through inheritance. Out of this, 72.7% of them were males while 2.7% were female – showing that there were more males involving in acquiring farmland through inheritance than females. Also, 3.6% and 7.3% of the respondents acquired their farmlands through purchases and rented on yearly basis respectively. The result, however, revealed that inheritance is the land ownership pattern that is common in the study area. The age distribution shows that 70.9% of the respondents are above 56 years of age while 29.1% of the respondents are above their active stage. This may have negative impact on the farm size as aged people may not have enough strength to cultivate large farms. However on the other

hand, the development may have positive impact on the farming experience. Older farmers would have more experience than the younger ones. Table 1 also showed that 85.4% of the respondents were married while the rest were not married. The implication of this finding is that there is possibility of more availability of family labour. As regards the educational level of the respondents, Table 1 showed that 66.4% of the respondents had no formal education while 33.6% had formal education. Hence majority of the respondents had no formal education. This may reduce the respondent's efficiency, as only few of them may be able to adopt and practice new technologies on their farm.

Gender involvement in production stages of kola nut

Table 2 showed that five stages of production were identified in kola production. The stages are farm clearing, chemical application, harvesting, on-farm processing and kola nut preservation. The result shows that 83.6% of the respondents involved in farm clearing were male while 16.4% were female. Hence, more males were involved in farm clearing than females. This is quite obvious because farm clearing is a tedious operation, hence not many females will be able to have enough strength to carry out the operation.

Table 2 also revealed that 81.8% of the respondents involved in chemical application were males while 18.2% were females. Therefore, there were more males involved in chemical application than females. The finding is logic in as much that chemical application also requires much strength which could only be provided by males. 74% of the respondents involved in harvesting were males while 25.5% of the respondents were females. Hence, more males were involved in kola nut harvesting team females. However, it could be observed in Table 2 that 89.1% of the total respondents involved in on-farm processing were females – while just 10.9% were males. Hence, on farm kola females in the study area mostly undertake processing. As regards preservation of kola nut, 70.9% of the respondents that were involved in this operation were females while 29.1% were males showing that there were more females involved in this operation than males.

It could be observed that females mostly undertook on-farm processing as well as preservation operations. This is quite obvious in as much that these operations do not require much strength hence more females would find it so easy to undertake them. Meanwhile, some of the problems faced by the respondents in the course of their work are lack of capital, lack of good storage facilities, lack of good roads and fluctuations in price.

Table 1. Socio – Economic Characteristic of Kola Farmers

Characteristics	*Male*		*Female*	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Gender	167	83.6	33	16.4
Ownership pattern				
(1) Inheritance	145	72.7	5	2.7
Purchased	7.0	3.6	7	3.6
Rented on yearly basis	15	7.3	20	10.0
Age Distribution of respondents				
26 – 35	7	3.6	2	0.9
36 – 45	15	7.3	4	1.8
46 – 55	27	13.6	4	1.8
56 – 65	54	27.3	9	4.5
Above 65	64	31.8	15	7.3
Marital Status				
Single	5	2.7	0	0
Married	162	80.9	9	4.5
Widowed/Separated	0	0	24	11.8
Educational Level				
No formal Education	113	56.4	20	10
Adult literacy school	22	10.9	5	2.7
Primary Education	18	9.1	4	1.8
Secondary Education	11	5.5	2	0.9
Tertiary Education	0	0	0	0

Table 2. Stages in kola nut production

Stages	*Male*		*Female*	
	Frequency	Percentage	Frequency	Percentage
Farm clearing	167	83.6	33	16.4
Chemical application	163	81.8	37	18.2
Harvesting	149	74.5	51	25.5
On farm processing	21	10.9	179	89.1
Preservation	58	29.1	142	70.9

Conclusion

There were more male respondents (83.6%) than female respondents (16.4%) in the study area. Most (66.4%) of the respondents had no formal education while only 33.6% of the respondents had formal education. The identified stages in kola nut production in the study area are farm clearing, chemical application, kola nut harvesting, on-farm processing of kola nut as well as kola nut preservation. More males were involved in farm clearing (83.6%), chemical application (81.8%) and harvesting (74.5%) while there were more females involved in on-farm kola nut processing (89.1%) as well as kola nut preservation (70.9%).

Recommendations

1. Illiterate farmers among the respondents should be encouraged on their need to acquire formal education, as this would make them to be more efficient in their production. The encouragement could be inform of granting free adult education.
2. Policies to make loans available to farmers should be initiated, as the importance of capital cannot be over emphasized in kola nut production.
3. Improved processing methods geared towards improved storage and enhancement of the nutritive value of kola nut should be introduced in the study area.

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Experimental Title: Awareness of cashew products potentials and market information among farmers in Kogi State, Nigeria**.** **(**Agbongiarhuoyi A.E., Uwagboe, E..O., Adebiyi, S. Ndagi, I. and Aigbekaen E.O).

Introduction:

Cashew (*Anacardium occidentale L.*) is an

important industrial and export crop whose potential is yet to be fully exploited in Nigeria (Asiru, *et al.,* 2005). Cashew is indigenous to Brazil but India nourished it and made it a commodity of international trade. The annual world production of cashew nut according to Opeke (2005), the main commercial product of the cashew plant is about 400,000 tonnes and more than 50 percent of this production comes from South Asia and East Africa, especially India, Vietnam and Tanzania. Among 13 countries included in cashew production as noted by Krishnaswamy (2006) in the African zone, Nigeria ranks fourth after Tanzania, Cote d' Ivoire and Guinea Bissau, having a total area of 100,000ha and an average annual production of 80,000MT contributing almost 16% of the total production of this particular zone. Its production is 5% of the global situation. During the last three years, Nigeria has been one of the suppliers of raw cashew nuts exported to India. Nearly 18,000 to 23,000MT of raw nuts per annum have been exported. The nut exported is negligible when compared with its total production. In Nigeria, cashew grows successfully in virtually all agro-ecological zones including the semi-arid areas but with high concentration in the middle belt areas in smallholder farms and plantations. Cashew production comes from over 20 States. These include: Kogi, Kwara, Oyo, Edo, Ondo, Anambra, Enugu, Benue, Cross River, Imo, Sokoto, Nassarawa, Ogun, Osun, Plateau and Kebbi among others (Ezeagu, 2002).

Economic Uses of Cashew:

Cashew has for many years been used for food and income generation. Cashew nuts (kernel), wine, pulp, apple and Cashew Nut Shell Liquid (CNSL) are produced from cashew (Crusoe, 2006). In spite of the above economic uses of cashew, there are twin issues of value addition in cashew produce and lack of recognition of Nigeria as a producer and exporter of cashew kernel to the international markets which pose serious challenge to its sustainability, income and job creation. In many cashew farms, a lot of the fleshy apple and some nuts waste away despite their potential economic uses; because many farmers do not have the capacity to adequately turn the produce into valuable products for local and international consumption and marketing.

Objectives:

The study is aimed at investigating the awareness of farmers in cashew products potentials and ascertains the type of market information available to the farmers.

The Specific objectives were to

1. determine the socio-economic characteristics of cashew farmers;
2. ascertain the knowledge of cashew value addition;
3. identify the market information on cashew production.

Hypothesis: It was hypothesized that:

1. There is no significant relationship between cashew farmers' socio-economic characteristics and awareness of cashew products; and
2. There is no significant relationship between knowledge of cashew farmers and awareness of cashew products.

Methodology: The study was carried out in Kogi state in the middle belt (North-Central) region of Nigeria. Kogi is a major cashew producing state in the country. Agriculture is the mainstay of the people and the principal crops grown are cashew, coffee, cocoa, oil palm, peanuts, maize, cassava, yam, rice, and melon (Wikipedia, 2007). Data was collected using purposive and systematic random sampling techniques. Three Local Government Areas: Igalamala, Dekina, and Ankpa dominant for cashew production were randomly selected. From them, five main communities noted for high cashew production were now purposively selected. These were Ajaka, Ankpa, Egume, Ochaja

and Odolu. A systematic random sampling was used to select 60 respondents using well-structured questionnaire. Descriptive statistics (frequencies, percentage, mean) and Pearson product moment correlation co-efficient (PPMC) were used to analyze the data.

Result and Discussion

Socio-economic Characteristics of Respondents

The data collected from the sixty respondent farmers in Kogi State revealed that 88.3 percent of cashew farmers were male while 11.7 percent were female indicating that more males were involved in cashew production than the female (Table-1). A higher percentage of the respondents 93.3 percent were married while 6.7 percent were single. The mean age of the respondents was 49 years indicating that more old people were involved in the cashew production. Table-1 showed that most (45%) of the farmers have had long farming experience in cultivating cashew, as the mean was 17 years. Those who had some form of formal education were mainly in the primary and secondary school categories of 41.7 and 38.3 percent. Table-1 also revealed that 48.3% of the farmers cultivate between 0.8-8ha while 25.3 of farmers cultivate between 8.1-15.3 ha. Also, 15% cultivate 15.4-22.6 ha and 8.4% farmers cultivate over 22.6 ha. It means that the small-scale farmers constitute about 50% in the lot of cashew farmers in Kogi State.

Awareness of Cashew Products

Table-2 showed that all the respondents were aware that kernels, juice and fire wood (100%) each could be derived from nuts, apple and cashew shell respectively. Also, 95 percent knew that wine is produced from cashew apple while the same percentage is aware of CNSL being made from cashew shell. Only pulp and prunes were of lower awareness to the respondents. This implies that there is high level of awareness of cashew products among farmers and this could enhance its potentials when fully developed by local processors in the study area.

Cashew Market Information by Respondents

Table 3 revealed that most of the respondents (96.7%) claimed to have had access to cashew market information. This result corroborates the findings of Uwagboe, *et al* (2006) that market information is considered very vital as it ensures prompt evacuation of produce to avoid spoilage when there is proper linkage between the farmers and buyers. The principal types of information respondents were knowledgeable of are consumption of kernel and export of cashew nuts (100%) each, cashew selling price (98.3%) and adding value to cashew produce (96.7%). Majority of the respondents however did not have knowledge of demand (98.3%) and supply (96.7%) of cashew in different areas of production in Kogi State. Though the respondents seem to have had high knowledge of selling price of cashew nuts, the mean selling price per kg/bag and basket were ₦3,040 and ₦272 only. It implies that the purchase price for cashew nuts is low irrespective of their knowledge level. The inadequate knowledge of demand and supply within the state could make buyers dictate prices for producers. Table 3 further showed that a reasonable amount (95%) of the respondents obtained information on cashew marketing from Cashew Association of Nigeria. It means that the social group proved to be more effective than other sources.

Correlation of Awareness and Knowledge of Cashew Products on Farmers' Socio-economic Characteristics

Table 4 revealed that, awareness of cashew products is significantly related to knowledge of farmers r = 0.38. The null hypothesis was rejected. It implies that the more a cashew farmer is aware of cashew products potentials, the more his knowledge about

them. The table also indicated that knowledge directly influence farmers characteristics such as farm size r = 0.25. This means that the more knowledgeable a farmer is on cashew products, the more the farm holding would be. In Table 4, there is a positive correlation between farming experience in cashew production and awareness of cashew products. It means that the higher the experience of a cashew farmer, the higher would be his awareness on cashew products and potentials.

. **Tables**

Table-1. Socio-economic characteristics of respondents.

Characteristics	Frequency	Percentage	Mean
Sex			
Male	53	88.3	
Female	7	11.7	
Marital status			
Married	56	93.3	
Single	4	6.7	
Age (years)			**49.0**
30-40	16	26.7	
41-51	21	35.0	
52-62	13	21.7	
63-73	10	16.6	
Farming experience			**17.0**
(years)	27	45.0	
7-15	22	36.7	
16-24	11	18.3	
25-33			
Educational status	5	8.3	
No formal education	25	41.7	
Primary education	23	38.3	
Secondary education	1	1.7	
Tertiary education	6	10.0	
Adult education			
Farm size (ha)	29	48.3	
0.8-8.0	17	28.3	
8.1-15.3	9	15.0	
15.4-22.6	5	8.4	
Above 22.6			

Source: Field survey, 2007

Table-2. Distribution of respondents according to awareness of cashew products.

Products	Awareness	No Awareness
Kernels from nuts	60 (100)	-
Wine from apple	57 (95.0)	3 (5.0)
Juice from apple	60 (100)	-
Pulp from apple	1 (1.7)	59 (98.3)
Prunes from apple	1 (1.7)	59 (98.3)
CNSL from shell	57 (95.0)	3 (5.0)
Fuel wood from shell	60 (100)	- -

Source: Field survey, 2007
Figures in parentheses are percentages.

Table-3: Access to cashew market information by respondents.

Variable	Knowledge Frequency	Percentage	No knowledge Frequency	Percentage
Market information access	58	96.7	2	3.3
Type of information				
Cashew selling price	59	98.3	1	1.7
Supply in different areas	2	3.3	58	96.7
Demand in different areas	1	1.7	59	98.3
Cashew nut consumption	60	100	-	-
Cashew value addition	58	96.7	2	3.3
Export of cashew nut	60	100	-	-
Information source				
Cashew association	57	95.0	3	5.0
CRIN	1	1.7	59	98.3
Fellow farmers	2	3.3	58	96.6

Table 4: Correlation of farmers' socio-economic characteristics and awareness of cashew products.

Variables	p	r	Decision
Knowledge of farmers	0.0025**	0.38	S
Farm size	0.0512**	0.25	S
Farming experience	0.0001**	0.68	S
Age of farmer	0.7984	0.03	NS

** Significant at $p<0.05$. p = Probability r = Coefficient S = Significant NS = Not significant

Conclusion: The study showed that farmers were quite aware of most of the cashew products: kernels, juice, fuel wood, wine and CNSL but with low awareness of its potentials. The main types of markets information which farmers had knowledge of

were cashew nut consumption, export of nuts, selling price and value addition. There is less knowledge on demand and supply of cashew in different areas. This could have some implication on farmers' market price and income. Farm size and long years of farming experience were significantly related to awareness of cashew products. It is recommended that to harness the enormous potentials of cashew products, sensitization and training be given by cashew association of Nigeria and other development agencies to assist cashew producers

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Experimental Title: Assessment of pests and diseases control by cocoa farmers in Kwara State, Nigeria**.** **(**Uwagboe, E.O., Agbongiarhouyi, A.E, Adebiyi, S. Ndagi, I. and Aigbekaen, E.O)

Introduction

Nigeria produced around 160,000 tonnes of cocoa in the 2006-2007 season, but current output is one-quarter lower than it was 30 years ago (Akinwale, 2008). One of the major reasons for the poor yield is diseases and insect pests, which have been estimated to cause 20-30% crop losses. Among other factors responsible for the declining production of cocoa in Nigeria is the vacuum created by the abolition of the Nigerian cocoa marketing board, old age of the farmers, massive migration from rural areas, scarcity and high cost of agricultural labour, incidence of pests and diseases, lack of credit facilities to cocoa farmers and indiscriminate bush burning that affect cocoa plantation (CDU, 2003; CRIN, 2003). Worldwide, pre-harvest and post-harvest losses to insects, weeds, and plant pathogens are estimated at 45 percent (Pimentel, 1991).

Black pod disease caused by *Phytophora. pamivora* and *P. megarkaya* is a major constraint to the cocoa production in West

Africa countries including Nigeria (Flood *et al*., 2004). Losses can reach up to 100% of the cocoa production in smallholders' plantations when no control measures are taken (Berry and Cilas, 1994). Capsids or Mirids cause a lot of lossess in cocoa farms the most important species of capsids in Nigeria are *Distantiella theobroma* (Distant), *Sahlbergella singularis* (Haglund) and *Helopeltis sp*. (Wood and Lass, 1985; Acquaah, 1999). One of the major control measures adopted by farmers is the use of pesticides even those ones that are bound. See Table 1 for recommended pesticides. Integrated pest management (IPM) has been a response to the need for improving pest management and reducing the environmental impacts of chemical pesticides. Integrated pest management (IPM) is an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, use of resistant varieties, habitat manipulation, and modification of cultural practices. Pesticides are used only after monitoring indicates they are needed according to established guidelines, and pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the environment (Strand, 2000). Cook (1986) reported that high crop yields can be achieved with sustainable agriculture if plants are protected from diseases and pests. This will make plants to grow well, take up nutrients, compete with weeds and yield to the limit of their environment. This study focuses on the assessment of the measures adopted by farmers towards controlling these insects and diseases infestation in Kwara state.

Objectives:

1. To ascertain the personal characteristics of the respondents in the study area.
2. To examine the farmers' methods of controlling insect pests and diseases.
3. To investigate the cocoa bean yield of the respondents in the study area.

Sampling Procedure and Survey

A total of 110 samples of cocoa farmers were interviewed individually in two Local Government Areas (Irepodun and Isin) in Kwara state. In the LGAs, two villages (Olowonijere, and Kajola) were randomly selected while 55 farmers were sampled from each village giving a total of 110 farmers from the two LGA's. Data collected include, socio-economic characteristics, Farmers' pest control methods and revenue generated from farmers'cocoa farms. Frequencies, percentages, charts and Chi-Square (X^2) were used for presentation and analysis of the data collected.

Results and Discussion

Findings in table 2 indicates that most (90.91%) of the farmers are males while 9.09% are females, this implies that it is mostly men that are actively involved in cocoa production in the study area, though the female ones have their role to play especially in the processing of cocoa. According to Gockowski and Oduwole (2001), women restricted access to land resources should be investigated. The study revealed that majority (54.55%) of the respondents is in their prime age which indicates that they are still active in cocoa farming and be able to perform pest control. In a study carried out by Amos (2007), he found out that age of farmers and age of farms reduce the efficiency level of cocoa farmers.

Education is a major factor that could influence farmers practices, in this survey 74.55% of the respondents had formal education, mostly primary (33.64%), adult education (7.27%) and secondary education (24.55%), while 25.45% had no formal education which indicates that most of the respondents are educated and could easily adopt technologies transferred to them which will increase their income for carrying out

insect pests and diseases control. According to Rogers (1983) education is thought to reduce the amount of complexity perceived in a technology thereby increasing a technology's adoption. .

Many (50.91%) of the respondents had between 1 and 20 years experience in cocoa farming which indicates that cocoa farmers had little experience in the study area. Some 41.82%) of the farmers had between 21 and 40 years while few 7.27% had between 41 and 60 years experience in cocoa cultivation which translate into long experience. According to Olujide (2006) long experience of farmers is expected to have positive effect on their knowledge about farm hygiene and the maintenance of cocoa trees. This experience is important for day-to-day running of the farming activities which include insect pest and disease control.

In Figure 1 the result revealed that most of the farmers are smallholders as majority (65.00%) of the farmers have between 1 and 5 acres. Farm sizes as categorized by STCP Nigeria Baseline Survey in 2001 are; Small 0.4 to 6 acres, Medium 6.1 to 12 acres, Large 12.1 + acres categories.

Table 3 shows the frequency of control measures of insect pest and diseases practiced by farmers. Majority of the respondents (87.27%) frequently used pesticides as their control measures while very few (7.27%) claimed to rarely use pesticides. This implies that most farmers in the study area use other phytosanitary methods rarely but concentrate more on pesticides application.

According to Wood and Lass (1985) and Akrofi et al., (2003) Black pod spores may be spread through rain splashes by vectors such as ants, and by wind, with the newly infected pods (covered with sporangia) acting as infection sources for up to 14 days . Most (65.45%) of the respondents rarely remove diseased pods from their farms which could lead to spread of diseases in the farm. In this study many (59.09%) of the respondents rarely remove mistletoe from their farms which is an indication that they do not practice phytosanitary regularly to reduce insect pests and diseases from their farms. Mistletoes obtain water and nourishment from the host plant (Polhill and Wiens, 1998). It causes damage of economic significance.

Pruning is an important cultural method of pest management operation and can affect yield as well as affecting the shape and create adequate aeration for the plant. In this study most (72.73%) of the farmers rarely practice pruning. Pruning is an IPM technique and effective IPM requires regular field monitoring of pests conditions to identify the critical periods for application of a pesticide or other control measures (Adipala *et al,* 1999).

Access to an adequate workforce at critical times during the growing season of cocoa is important and, for most, the family remains the primary labour source. From the findings of this study most (86.36%) of the farmers practice manual weeding which indicates that labour availability is not a problem in the study area

It has been ascertained that the farmers are small holding farmers which conforms with the revenue generated from their farms. In figure 2 many (54.55%) of the respondents earned between ₦1 and ₦10, 000 in 2008 from their sales which is very low income for farmers to be able to control pest infestation. Today, cocoa-farming remains a labour intensive and demanding source of income but also one that offers a natural competitive advantage to the regions in which it is grown (ICCO, 2006).

Characteristics	Frequency	Percentage
Sex		
Males	58	96.70
Females	2	16.67
Total	60	100.00
Age		
20-40	15	27.27
41-60	60	54.55
61-80	20	18.18
Total	110	100.00
Educational status		
Adult Education	8	7.27
Primary	37	33.64
Secondary	27	24.55
Tertiary	10	9.09
No formal Education	28	25.45
Total	110	100.00
Farming Experience		
1-20	56	50.91
21-40	46	41.82
41-60	8	7.27
Total	110	100.00

In table 4, the result revealed that method of pests control is significantly related to cocoa yield (r=0.305, P=0.018), whereas other variables such as years of experience is not positively related to cocoa yield (r=0.232, P=0.113). Which implies that method of pest control by the respondents
affect their yield while years of experience do not have any effect on the yield of the respondents. The r^2 of 59 indicates an average strength of the relationship.

Tables and Figures

Table 1: Personal characteristics of the respondent

Source: Field survey, 2008

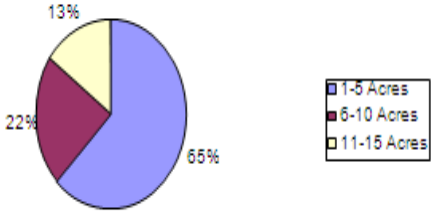

Figure 1: Size of farms in Acres

Table 2: Frequency of Control measures for insect pest and diseases practiced by farmers (n=110)

Farmers' practices	Rarely	%	Frequently	%	Very frequently	%
Application of pesticides	8	7.27	12	10.91	96	87.27
Removal of diseased pods	72	65.45	32	29.09	18	16.36
Removal of broken pods	90	81.82	10	9.09	14	12.73
Removal of mistletoe	65	59.09	45	40.91	12	10.91
Pruning	80	72.73	28	25.45	14	12.73
Weeding	3	2.73	8	7.27	95	86.36

Table 3: There is no significant relationship between pesticides used and cocoa yield of farmers in the study area

Cocoa yield	r	P	r^2	Decision
Method of pests control	0.305	0.018	59	S
Years of cocoa farming experience	0.232	0.113	48	NS

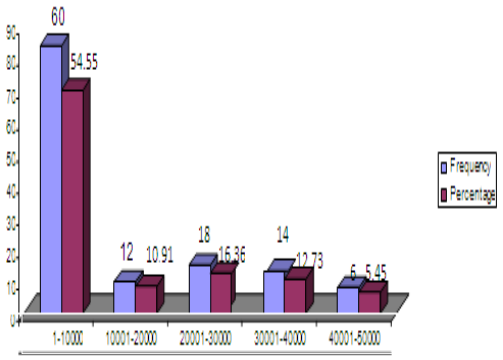

Figure 2: Revenue of farmers in 2008

Conclusion and Recommendations

Most of the farmers are males and few educated with long experience. The farmers are smallholders and have high dependency on pesticides measure for controlling insect pests and diseases and rarely carried out phytosanitary practices. The revenue generated from most of their farms is very low.Hence there is need for government to

bring up policy that would favour women's' access to resources like land and provide credit to small scale farmers in order to enhance their production level.

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STATISTICS SOCIO ECONOMICS AND TECHNOECONOMICS PROGRAMME

Experimental Title: Rural infrastructure development and CRIN mandate crop sub-sector. (Shittu, T. R.; Sanusi, R. A.; Adejumo, M. O and E. O. Aigbekaen ;)

Introduction

Infrastructure can simply be described as the basic system and services that are necessary in a country or an organization, e.g. building, transport, water and power supplies and administrative systems (William et al, 1973). Rural infrastructures is grossly deficient in Nigeria (FMA&RD, 2001) because the rural areas lack the enabling infrastructure essential for both the transformation of rural communities and enhanced productivity as well as the welfare of rural dwellers. It is the recognition of this fact that lead to the creation of several agencies by government in the past to address the problem of rural infrastructures. The agencies include Agricultural Development Projects (ADPs), River Basin and Development Authorities (RBDA), (defunct) National Agricultural Land Development Agencies (NALDA) and Directorate of Food, Road and Rural Infrastructure (DDFFRRI). These agencies were able to record some achievements but the gains from their efforts were not consolidated due to changes in government policies and/or polity leading to the dismantling of some of the agencies or a redefinition of their mandate focus.

Justification

Infrastructural deficiency is a major constraint to rural development and which significantly contributes to increased impoverishment in the rural communities in Nigeria. According to FMA&RD (2001), due to pervasive rural poverty, the provision of private infrastructure may not always be profitable since costs cannot be fully recovered; hence, it was recommended that public – private sector collaboration and improved community participation (which is low currently) approach be adopted in the provision of rural infrastructure.

Development of (rural) infrastructure impact on agricultural production through reduced transaction costs, increased technology diffusion, new input – output combination, reduced input prices, increased specialization and commercialization as well ad improved entrepreneurial capacity (Binswanger et al, 1993; Dedehouanou, 1999; Todaro, 1989). Infrastructural advancement equally has implication on consumption pattern, family planning, gender relations and health (Binswanger et al, 1993); Dedehouanou, 1999; Todaro, 19890. It could also have negative impacts such as undesirable environmental occurrences (Binswanger et al. 1993; Dedehouanou, 1999; Todaro, 1989).

Objectives of the study

The main objective of this study is to analyze the effects of rural infrastructure on agricultural production particularly CRIN mandate crops. The specific objectives are to:

1. Analyze the socio-economic characteristics of CRIN mandate crops farmers.
2. Determine the impact of rural infrastructure on CRIN mandate crops in the study areas.

Methodology

Both primary and secondary data were used in this study. The primary data was collected using a multi-stage random sampling technique. The first stage involved purposive selection of 2 states (Ondo and Kwara) from CRIN mandate crops growing states in Nigeria was done. The second stage was the selection of 2 Local Government Areas (LGAs) per selected state using operational zoning of the Agricultural Development

Programmes . The third stage was a random selection of 20 villages in the selected LGAs with the aid of ADPs. In the fourth stage, 5 farmers were sampled from (each) selected state using well-structured questionnaire.

Secondary data used for the study were collected from the State's Ministry of information as well as the selected LGAs Headquarters. These process involve data collection on infrastructure distribution in the LGA.

Data collected was then analysed using Descriptive statistics such as frequency, percentage, measure of dispersion, mean and cummulativve mean.

Also a common infrastructive index based on village level information was constructed for all elements that could be used to rank villages to reflect their developmental status. This is due to the fact that this not only sinplifies ranking of villages by reducing a large amont of data to a single measusre, it also takes care of qualitative aspects of infrastructure in a quantitative manner.

In this study, distances from the village to 8 element of infrastructure were obtained across the selected 19 villages in the study area. The selection of these 8 elements was based on their relative homogeneity across the selected villages.

A total cost of infrstructure availability (TC) was computed by suming the Average Cost (ACi) of getting to a particular infrastructure in the 19 villages. ACi was however obtained as an average individual transportation cost (IDci) of the respondants in each of the 19 villages. The use of transportation cost was due to the interaction that exists between transport facilites and institutional infrastructure (Ahmed and Hossains (1990). Thus, a village may be close to input purchasing centre and yet access to the centre may be more difficult than a a village located a bit far wasy, if the latter has better transport system which is normally reflected in the transportation cost.

The infrastructural index (I) was obtained by finding the average of the Wis of the 8 infrastructural facilities such infrastructure is located cilities for each of the 19 villages.

Algebraically :

$$ACi = \frac{\sum_{i=1}^{n} IDci}{n} \quad (1)$$

$$TC = \sum_{i=1}^{19} ACi \quad (2)$$

$$ATC = \frac{TC}{N} \quad (3)$$

$$W = \frac{ACi}{ATC} \quad (4)$$

$$INF = \frac{\sum_{i=1}^{8} Wi}{n} \quad (5)$$

Where IDci = Individual transportation cost of getting to each infrstructure by the respondents in each village

ACi = Average ast of transporation in each village

TC = Total cost of transportation to a particular infrastrucsture across villages

ATC = Average total cost of transporation across villages

Wi = Weight of Average Transportation cosst in eaach village

IN = Infrastructure Index

N = Total No of Village

M = Total number of Infrstrucstural Facilities

N = Number of respondents in each village

The Infrastructural index (INF) indicates the degree of under development, thus the higher the value of the INF, the less developed the village considered. Another approach of grouping the villages into developed and under developed areas was to sum the infrastructural index for all the 19 villages and the average obtained. The villages with value above the average were said to be under

developed and those lesser than (below) the average were said to be developed.

Results and Discussion

The socio economic charaacteristics of the respondents are as follows:

Age: The distribution by age of the respondents shows that - % is within 40 and 59 of age. On the other hand - % are 60 yrs and above while - % are between the ages 30 -39yrs. Average are of the respondents was -. Thus - % age is within the productive age.

Education: no formal education = 13(24.5%), primary education =26(49%); secondary = 11(20.8%); tertiary = 4(7.5%)

Marital status = married = 45(84.5%); single = 1(1.88%); divorced = 3(5.66)%; widowed = 4.(7.5%)

Religion = christianity = 34(64.1%) ; islam = 14(26.4%); traditional= 5(9.4%)

Farming Exp. = 11-40 = 36(67.9%); < 10 yrs = 8(15%); .40 yrs = 9(16.98%)

No of mandate crops cultivated: 1 = 39(73.6%) 2 = 12(22.6%), 3=2(3.8%)

Farm Size: 1 – 5ha=10(18.9); 6 -10ha =22(41.5%); 11- 15ha= 13(24.5%); ≥16ha= 7(13.2%)

Infrastructures Accessibility of the 19 village.

Access to infrstracure was measured by the average transportion cost of the respondents to the points where such infrastructure is located. The cost varied widely in some and minimal in others for each infrastructure and across villages. The costs are grouped into 3; those that are less than or equal to 200, between 201 and 500 and those greater than 500. Infrasstrutures with higher cost of transporation are considered not readily available, thus the higher the costs, the higher the level of under development.

Table 1: Access to Infrastructure of the 19 villages

Infrastructure	≤200		201≤500		>500	
	Freq	Percent	Freq	Percent	Freq	Percent
Telecommunication	13	68	3	16	3	16
Electricity	16	84	2	11	1	21
Good Road	9	47	6	32	9	47
Pipe borne water	11	21	7	37	7	13
Borehole water	7	13	7	37	3	16
Market	10	53	6	32	15	5
Health centre	8	15	5	26	12	23
Hospital	1	5	4	21	13	68
Average	9	38	5	27	8	26

An average of a villages (%) of the village studied are classified as village with access cost of less than or equal to.

The average cost for this group is:

Infrastructural Index: This was done to have a true knowledge of under development. These ranged between 0.51 and 2.60 with an average index of 0.97 for the 19 villages. The higher the value of the index above the average value, the less developed is the infrastructure and the lower the value below the average, the more developed. All the 19 villages studied were classified into four groups as follows Highly developed ≤ 0.70, Moderately developed 0.71 --- 0.97; moderately under developed 0.98 – 1.40 while highly under developed was ≥ 1,40.

Table 2: Village Distribution by Level of their Infrastruture Development.

Range of Index Number	No of Village	percentage	Cummulative Percentage
0.60	5	26	-
0.60-0.87	6	32	26
0.88-1.30	5	26	58
1.31	3	16	84
Total	19	100	100

10 Villages of 5 each representing 26 percent fall into the category of highly developed and moderately under developed villages respectively; 6 villages belong to category of moderately developed while 3 villages fall into the category of highly under-developed

villaages. These represents 32 perccent and 16 percent respectively.

Conclusion: Cost of transporation, a direct function of rural road network status have been employed in this study as a measure of under-development .Investment therefore in rural roads and transporation could result in reducing the cost of transportation of goods (input and output) and passengers. This would then increase the share of farmers in the final realization of farm produce, thererby increasing their welfare.
Infrastructure indirectly affects Agricultural Production through prices of inputs, and where infrastructure is well developed there would be reduced cost of business transaction, easy access to current information, improved access to global opportunities hence acceleration of economic development.

Experimental Title: Determination of volume of the traded kolanut in Southwestern Nigeria. **(**Oduwole, O. O, Adejumo M.O, Shittu,, T. R , Aigbekean, E. O.)

Introduction
Kola is one of the economically important cash crop in Nigeria. There are over fifty species of kola. Of these, seven have edible nuts, but only two have been widely exploited, these are *cola nitida* and *Cola acuminata.*
These species have been important objects of trade for a long time. The most important is *Cola nitida* because of its wide economic value while Cola *acuminata* is confined to the southern forestlands of Nigeria in term of production and consumption; Cola *nitida* is of inter regional and international trade. The inter- regional trade is said to be by far the most important arm of the Nigerian kolanut market(in terms of organization) as it accounts for 80% of traded kola produced (Akinbode,1982).

Nigeria produces 88% of the world's kola production and 90% of this is consumed locally while the remaining 10% is exported. This finding was buttressed by Olokun and Oladokun (1999) who claimed that Nigeria produces two million metric tons of kolanut annually which represented 70% of the world's kolanut production.

Present day consumption of kola nut extract is 0.69 mg/kg/day. Kola nut, apart from the fact that it is widely consumed by virtually all categories of income groups, the commodity has been found to be useful in the production of beverages, flavouring material alkaloids, caffeine, theobromine, laxatives, heart stimulants and sedatives. In addition, kola nut husk which is a by-product from processing the seed is widely used for animal feeding because of its high nutritive quality and there was a report that there has been an outstanding growth performance and the apparent nutrient utilization of broilers fed with kola nut husk meal diets (Babatunde and Hamzat, 2005).

However, with all these robust potentials from kola, the crop has been faced with some challenges. According to Facheux *et al* (2001), there are clear limitations to significantly increasing income from kola nut business as a result of limited market access, low resource regeneration, limited available capital and lack of appropriate technology.

Annually, an increasing number of Nigerians earn their living as kola nut producers, traders, middlemen or professional packing men. But interesting, kola marketing is largely disorganized thus making revenue generation by government impossible as there is paucity of information on the volume of traded kola nuts between the south-western markets (producing region) and the northern markets (consuming region).

Objectives

It is in view of all these limitations that this study was embarked upon thus the objectives are:

1. To measure the volume of the traded nuts in our major kola markets;
2. To know whether kola is really getting the desired attention in the markets;
3. To proffer solutions to the problems of kola trading in the study area.

Methodology

The study was carried out in four states of Nigeria namely; Oyo, Ondo, Ogun and Osun states respectively. These states are kola producing states in the south western part of Nigeria. In each state, at least two major market centres were selected although all the major kola markets in the selected states were visited but the study was restricted to only two markets in each state, markets such as Idi Iroko, Ijebu mushin and Mamu were visited in ogun state while Oniparaga and Yaba were visited in Ondo, Ife and Osogbo market were visited in Osun and Oja-oba and Ojoo markets were visited in Oyo State . A total of 200 traders were randomly selected and interviewed in all the states. Information was collected from the respondents with aid of structured questionnaire. The collection of the information was done between October and November 2009.

The data from the information collected was analyzed with descriptive statistics, Ordinary least square and regression analysis.

Descriptive statistics- frequency and percentages were employed here to analyze the socio-economic characteristics of the respondents.

It is also used to analyze the quantity of baskets traded for the period of interest in each state.

Results and Discussion

From the analysis done so far, it was discovered that majority of kola marketers/ traders (respondents) are women and they are within the age range of 41-55 years with primary or no formal education.

About 68% of the respondents have more than 10 good years of experience in kola nut trade, 81.25% of them got motivated into the business because it was their family business. 90% of the respondents buy fresh nut and they process it before sales while majority of the traders buy mixed nut instead of going for white or red nut.

In Mamu, the average quantity of kola nut traded for that year is about 200,000 baskets on the average while in Mushin about 100,000 baskets were traded. In Oyo state more than 210,000 baskets were traded in Oja-oba in Ibadan south east while 150,000 on the average were traded in Ojoo market, the same also go for Osun and Ondo state.

On the average, more than 200,000 baskets of good kola nut are exported to the north annually from different market in south western zone of the country.

Experimental Title: Food demand among cocoa farming households in Nigeria. (K. A. Oluyole, R.A. Sanusi and E.O. Aigbekaen)

Introduction

The study of demand in economics is aimed at describing the purchase decisions of consumers. The theory of demand relating to consumer decisions describes the actions of consumers in their role as buyers as they interact with sellers in determining prices at the consumer market level (Sanusi, 2006). However, the level of this interaction may be influenced by the level of income, household size, age as well as close substitutes (Ishida *et al*, 2003). Food demand essentially depends on population and the dietary habits/per capita calorie intake of the people under

consideration. Nigerian population increased from 55,670,055 in 1963 to 140,005,542 in 2006 representing an increase of 151.5 percent (NPC, 2006). In Nigeria, the production of food has not increased at the rate that can meet up with the food demand of the increasing population (Oluyole *et al.*, 2009). While food production increases annually at the rate of 2.5 percent, food demand increases annually at a rate of more than 3.5 percent due to high rate of annual population growth of 2.83 percent (NBS, 1996). The apparent disparity between the rate of food production and demand for food in Nigeria has led to a food demand-supply gap, leading to a widening gap between the food available and the total food requirement and hence posing a threat to national food security. This study intends to derive the nutritional implications of the demand for food on cocoa farming households in the study area and the effect or otherwise of unit changes in prices and income on the availability of nutrients to households in the study area.

Objectives

1. To estimate demand elasticities for food items among cocoa farming households in the study area.
2. To determine the factors that affect the quantity of food demanded in the study area.

Methodology

Two cocoa producing states were chosen for the study; these were Ondo and Kwara states. Going by NCDC (National Cocoa Development Committee) classification, Ondo state is a high cocoa producing state while Kwara state is a medium cocoa producing state (NCDC, 2006). Simple random sampling technique was used to select one hundred and fifty respondents from the two states (one hundred cocoa farming households from Ondo State and fifty respondents from Kwara state). Structured questionnaire was used to collect information from the respondents and the data collected from the information was analysed using Almost Ideal Demand System (AIDS) and Multi-variate Regression function.

Almost Ideal Demand System (AIDS): Almost Ideal Demand System is defined as the budget share of a commodity as translog function of prices (of a commodity and related commodities) and other variables. The AIDS model is specified as:

$$\omega_i = \alpha_i + \sum \Upsilon_{ij} \ln P_j + \beta_i \ln(x/p^{\bullet}) + \mu_i \quad \text{.....(vii)}$$

ω_i = Budget share of commodity i;
P_j = Price of commodity j;
x = Total expenditure on the commodity being analyzed;
$P^{\bullet}$ = Laspeyeres Price Index;
i =1,2,3,……..n commodities;
μ_i = Random disturbance term.

A. The Price Elasticities for AIDS model, following Wen *et al* (2002), is given as:

$$(\ddot{E}_{ij}) = 1/(w)(Y_{ij}-\beta_i w_j) - \delta_{ij} \quad \text{..…….....(xi)}$$

δ is the Kronecker delta which takes the value of one for own price elasticity, that is i=j; and takes the value of zero for cross price elasticity, that is i ≠ j.

The Expenditure Elasticity for the AIDS model, following Wen *et al* (2002), is given as:

$$(\ddot{E}_i) = 1 + \bar{\beta}/w \quad \text{……. (xii)}$$

Note: Expenditure elasticity is a proxy for income elasticity

Multiple regression function: This was employed to assess the influence of some variables on the quantity of food demanded. The regression function for the quantity of food demanded was implicitly specified as follows:

Y = f(age, gender, edn, mar, hhz, fminc, offminc, fmexp, notimes, nonfdexp, e)…(xiii)

$$Y = y_a + y_b \quad \text{……..(xiv)}$$

Where:

Y = total quantity of food demanded (kg);
y_a = quantity of own produced food (kg);
y_b = quantity of food purchases (kg);
age = age of household head (years);
gender = gender of household head (male = 1; female = 2);
edn = educational level of household head (no formal education = 1; primary education = 2; secondary education = 3; tertiary education = 4);
mar = marital status of household head (married = 1; otherwise = 0);
hhz = household size;
fminc = farm income of household head (₦);
offminc = off-farm income of household head (₦);
fmexp = farming experience of household head (years);
notimes = number of meals taken per day;
nonfdexp = non-food expenditure (₦);
e = random error term.

Results and Discussion

In table 1, the own price elasticity for all the food items showed that the demand for these food items is price inelastic. It could also be observed in table 1 that none of the food items has own price elasticity greater than one indicating that a 1% increase in the price of the food items brought about a less than proportionate in the demand for the food items. In food items such as cassava flour (-0.9170), plantain (-0.8669), sugar (-0.8801) and fruit (-0.8254) with high own price elasticities shows that a change in their own price will result in a large change in their demand while food items such as rice (-0.3234), gari (-0.4790), meat (-0.4428) and milk (-0.4428) with low own price elasticities shows that a change in the price of these food items does not have much impact on their demand. The implication of this is that these food items are becoming staple foods among cocoa farming households in the study area. Hence, no change in price can have much impact on their consumption. Table 1 also showed income elasticity for the food items. The table showed that all the food items have positive income elasticity suggesting that all the food items are normal goods whose demand will normally increase with increasing total disposable income. The income elasticity of some food items such as cassava flour, plantain, sugar and fruit tends to be income elastic (income elasticity being greater than one). Hence, a percentage change (increase) in income results in a more than proportionate change (increase) in quantity demanded for the food items. Such items are normally referred to as luxury. Other food items such as rice, beans, yam, gari, maize, cocoyam, bread, egg, fish, meat, milk, beverage and vegetables have income elasticities lesser than one but greater than zero. Hence, the demand for the food items is inelastic with respect to income. A percentage change in income of consumer results in a less than proportionate change in quantity demanded of the food items and such food items are normal and necessity goods. However, food items such as beans, yam, gari, maize, cocoyam, bread, egg, fish, milk, beverage and vegetables having relatively large (but less than one) income elasticities of demand, it is expected that these food items will experience an increase in demand when consumers' income increases. An interesting finding was that rice tended to have the lowest income elasticity of demand (0.7171). This indicates that rice had already occupied a special position in the diet of cocoa farming households in study as a staple food. Quantity of rice consumed (demanded) is not expected to have a dramatic change with changes in income of the consumer.

Table 1: Demand Elasticities for the food items

Food Items	Own price elasticity	Cross price elasticity	Income elasticity
Rice	-0.3234	0.6766	0.7171
Beans	-0.5094	0.4956	0.9400
Yam	-0.7652	0.2348	0.9849
Gari	-0.4790	0.5209	0.9567
Cassava flour	-0.9170	0.0829	1.0216
Maize	-0.5965	0.4035	0.9933
Cocoyam	-0.5529	0.4471	0.9852
Bread	-0.7125	0.2875	0.9936
Plantain	-0.8669	0.1331	1.0169
Egg	-0.5191	0.4808	0.9935
Fish	-0.7169	0.2831	0.9697
Meat	-0.4428	0.5571	0.8205
Milk	-0.4243	0.5757	0.9781
Sugar	-0.8801	0.1199	1.0100
Beverage	-0.5782	0.4217	0.9931
Fruit	-0.8254	0.1746	1.0125
Vegetables	-0.6423	0.3577	0.9960

Results of the parameter estimates in the linear regression analysis is shown in table 2. The table shows that out of the ten variables investigated, six variables significantly affected the quantity of food demanded for. The variables are age of household head ($p<0.05$), household size ($p<0.05$), farm income ($p<0.1$), off-farm income ($p<0.05$), farming experience ($p<0.1$) and number of meals taken per day ($p<0.01$). As regards the age of household head, the result shows that as the age of household head increases, the quantity of food demanded for also increases. The result is in line with Asumugha *et al*, (2009) which found out that the demand for yam in the Northern Nigeria increases with age. Table 2 also shows that household size significantly and positively affected the quantity of food demanded for. As the household size increases, the number of mouths that would be fed also increases, hence, the quantity of food that would be required for to feed the entire mouths in the house also increases. The coefficients of farm income as well as off-farm income were positive and significant implying that increase in these variables will bring about increase in food demand. This result is also in line with the findings of Asumugha *et al.*, (2009). Increase in income will enable the household to devote more money for food purchases, thus increases household food demand. It could also be observed in table 2 that farming experience significantly and positively affected food demand. Increase in farming experience of household head increases the propensity of the household head to increase food production thus making more food available to meet the food demand of the household. The coefficient of number of meals taken per day by the households was positive and significant. The results conforms with the apriori expectation as the number of meals taken per day is expected to lead to increase in quantities demanded. Thus household will demand for more food when the frequency of food consumption increases.

Table 2: Multiple Regression Model Result

Variables	Coef.	Std. Err.	Prob.
Constant	0.805	0.850	0.345
Age of household head	0.368**	0.170	0.032
Gender of household head	-0.232	0.189	0.222
Educational level	-0.143	0.105	0.175
Marital status	-0.117	0.292	0.688
Household size	0.272**	0.115	0.019
Farm income	-0.047*	0.026	0.073
Off-farm income	0.023**	0.011	0.037
Farming experience	0.136*	0.076	0.077
Number of meals per day	1.247***	0.296	0.000
Non-food expenditure	-0.011	0.042	0.786
R-squared	0.6408		
Adjusted R-squared	0.6357		

*** significant at 1% level; ** significant at 5% level; * significant at 10% level.

Conclusion

The demand for all the food items investigated in the study area is price inelastic, hence, an increase in the price of the food items brought about a less than proportionate in the demand for the food items. All the food items under investigation are normal goods whose demand will normally increase with increasing total disposable income on the food items. Food items such as cassava flour, plantain, sugar and fruit tends to be income elastic while food items like rice, beans, yam, gari, maize, cocoyam, bread, egg, fish, meat, milk, beverage and vegetables were income inelastic. Rice tended to have the lowest income elasticity of demand, hence, it is a staple food in the study area. The quantity of

food demanded by cocoa farming households in the study area is affected by the age of household head, household size, farm income, off-farm income, farming experience and number of meals taken per day. The study therefore recommends that in as much that income was found to have affected food demand, the income generating activities of the farming households should be strengthened so as to get more money to demand for more food. This is quite imperative in as much that the quantity of food demanded for (consumed) is a function of the food nutrients taken.

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Experimental Title: Determinants of quality cocoa beans marketing in Nigeria: A socio-economic and techno-economic approach. **(**Aigbekaen, E.O. Sanusi, R.A.. Shittu, T. R. Oluyole K.A,. Obatolu, B.O. Lawal, J.O. Adejumo, M .O and. Oduwole, O. O.)

Introduction: The quality of cocoa has been known to be declining over the years. Improper post harvest handling due to sharp market prices was attributed to this phenomenon (Oduwole, 2004; Sanusi, 2006). Various measures were taken to address the problems such as establishment of a Tree Crop Development and Marketing Plc (TRECODEM) for the improvement of tree crop trade including cocoa by the Nigerian government (Adepoju, 2006).

Good quality cocoa been is a vital determinant of the value added products emanating from industrial processing of cocoa. Bad/low quality cocoa will increase the cost of bean processing. The higher the quantity of defects in cocoa bean lot, the higher the cost the processors will incure in terms of machines hour, mandays and production cycle.

The objectives of the study is to:

1. describe the socio-economic variables of the respondents
2. ascertain the major determinants of cocoa bean quality.

Methodology: The study was carried out in Ondo and Ogun states. Going by NCDC classification, Ondo state is a high cocoa producing state, while Ogun state is a medium cocoa producing state. From each state, one notable cocoa producing local government area was chosen and from each local government area, seventy cocoa producing

farmers were randomly selected thus making a total of one hundred and forty respondents used for the study. Information was elicited from the respondents with the aid of structured questionnaire while the data from the information collected were analysed with the use of descriptive statistics as well as probit model.

Descriptive statistics was used to address objective one while probit model was employed for objective two. The Probit model is given as:

$P_i = \beta_i E_i + \alpha_i$

Where: P_i = variable that indexes the cocoa bean quality classification. It exists in the form AP* that is, Pi = P* if A = 1 and Pi = 0, if A = 0.

Ei = vector of explanatory variables;

β_i = Parameter estimate;

α_i = random error term.

The explanatory variables included in the model are as given below:

AGE = age of farmer (years);

FMZ = farm size (ha);

FMT = fermentation technique (FMT = 1, if heap method is used and 0 otherwise);

DDR = duration of drying (number of days);

HVP = harvesting practice (HVP = 1, if pods are harvested as they ripened and 0 otherwise);

PBP = pods breaking practices (PBP = 1 if pods are broken with club and 0 otherwise);

CFM = cost of farm maintenance (N);

NFE = non-farm expenditure (N).

Results and Discussion:

Table1 showed the description of the socio-economic characteristics of the respondents. The table shows that 90.7% of the total respondents were males while just 9.3% were females. This shows that majority of the farmers in the study area are male. It could also be observed in table 1 that about 63.0% of the total respondents were 50 years and above. Hence, there are more old farmers than their younger counterparts in the study area. This may have negative impact on the farm size since young people are stronger and are expected to cultivate larger-size farm than older respondents. It might also have negative implication on the productivity of the cocoa farmers. The study also revealed that 89.3% of the total respondents were married. This shows that most of the respondents in the study area are married. This implies that there is the likelihood that there could be more family labour, available to farming households. As regards the educational status, about 70% of the respondents had formal education. Hence, most of the farmers in the study area had formal education. Education is a social capital; hence it could impact positively on farmers' ability to take good and well informed production system that will improve the quality of cocoa beans produced.

Table 2 showed the result of probit analysis. The table showed that out of the eight variables investigated, four were found to have significantly affected cocoa beans quality. The significant variables are age of the farmer ($p<0.01$), duration of drying ($p<0.01$), pod breaking practices ($p<0.1$) and cost of farm maintenance ($p<0.05$). As regards the age of farmer, the sign of the estimate shows that as the age of farmer decreases, there is more likelihood that the quality of cocoa beans increases. This is quite obvious because a younger farmer will be more active to carry out all the practices that would enhance the quality of his cocoa beans. Duration of drying was also found to have significantly affected cocoa beans quality. This is so because the longer the cocoa bean is dried, the less propensity for such bean to be spoilt. As regards the pod breaking practices, when club is used to break pod, there is likelihood that the cocoa beans inside the pod will not be injured thus enhances the quality of cocoa beans. Cost of farm maintenance was also significant because the more a farmer spends more money to maintain his farm, the more likelihood to get a good quality product (cocoa beans) from such a farm.

Table 1: Socio-economic variables of the respondents

Variables	Frequency	Percentage
Gender		
Male	127	90.71
Female	13	9.29
Total	140	100.00
Age		
≤30	3	2.14
31-40	27	19.29
41-50	47	33.57
51-60	20	14.29
>60	43	30.71
Total	140	100.00
Marital status		
Single	6	4.29
Married	125	89.29
Divorced	3	2.14
Widowed	6	4.29
Total	140	100.00
Educational Status		
None	37	26.43
Primary school education	61	43.57
Post- primary education	33	23.57
Tertiary education	3	2.14
Islamic education	6	4.29
Total	140	100.00

Table 2: Probit Model Result

Variables	Coef.	Std. Err.	P-values
Constant	-1.461436	2.076646	0.026
Age of farmer	-.0558567	.0167864	0.001***
Farm size	.0795641	.0597589	0.183
Fermentation technique	-.0931166	.2838258	0.743
Duration of drying	.6723223	.2428495	0.006***
Harvesting practice	-.1955382	.2157745	0.365
Pod breaking practice	.9401928	.5704171	0.099*
Cost of farm maintenance	7.08e-06	.0000171	0.038**
Non-farm expenditure	-.0000528	.000038	0.165
Log-likelihood	-39.856348		
Prob.	0.0001		
Chi-square	33.39		

*** Significant at 10% level, ** Significant at 5% level, * Significant at 1% level

Conclusion: From the empirical results obtained, it could be concluded that age of farmer, duration of cocoa bean drying, pod breaking practices as well as the cost of farm maintenance significantly affected cocoa bean quality in the study area.

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Experimental Title: Social capital and credit access among cocoa farming households in Ondo and Kwara States, Nigeria. **(**Lawal,J. O. and Sanusi, R. A.)

Introduction

In Nigeria, credit access is a major problem among rural farming households due among others to lack of adequate physical collateral. Credit to farmers is an important instrument for improving efficiency and expanding production and increasing productivity (Feder *et al*, 1990).

Studies have showed that households with better access to credit have greater capacity to absorb and pool risks across periods thereby stabilizing their production and consumption over time (Eswaran and Kotwal, 1990). Furthermore, improved access to credit may indirectly serve as an insurance substitute that can induce receptiveness to adoption of new technologies (Diagne and Zeller, 2001).

Also, there is growing recognition that differences in economic outcomes cannot be

explained fully by differences in "traditional" inputs such as labour, land and physical capital. According to Serageldin (1996), traditional composition of capital needs to be expanded to include social capital for sustainable development. Social capital, as defined by Portes (1998) stands for ability of people to secure benefits by virtue of their membership in social networks or other social structures. This is measured by six dimensions namely density of membership (DM), heterogeneity index (HI), decision making index (DMI), meeting attendance index (MAI), cash and labour contributions (Grootaert, 1999). The availability of social capital to households has been known to ameliorate the problems associated with collateral hence improving the poor's access to credit.

However, the main thesis of this study is to solve the dearth of information on the determinants of credit access of cocoa farming households in Nigeria.

Objectives

This study therefore examined:

1. The socio-economic and social capital characteristics of CFHs;
2. the constraints of cocoa farming households in accessing credit;
3. the determinants of Credit Access among the CFHs;
4. the bi-causal relationship between Social Capital and Credit Access among Cocoa Farming Households (CFH) in Nigeria.

Methodology

Data was collected from 120 cocoa farming households in the cocoa producing Agricultural Development Project (ADP) Zones in Ondo and Kwara States using Multi-stage sampling technique with the aid of structured questionnaire. These two states were chosen as representatives of the high and medium cocoa producing states as profiled by NCDC. Information collected was socio-economic, social capital and credit characteristics data. Analysis was done using descriptive statistics, social capital indices and censored Tobit regression model.

Results and Discussion

Table 1 showed the mean values of socio-economic characteristics for cocoa farming households by the states sampled.

Table 1: Socio-economic Characteristics of Cocoa Farming Households in Ondo and Kwara States, Nigeria

Variables	Mean	Std.Deviation	Minimum	aximum
	ONDO STATE			
Age (yrs)	58.0	15.3	30.0	91.0
Household size(number)	8.5	3.9	2.0	18.0
Years of Experience(yrs)	28.8	12.6	10.0	59.0
Age of Cocoa farm(yrs)	42.1	8.4	25.0	60.0
Farm size(hectare)	4.4	2.8	1.0	15.0
	KWARA STATE			
Age (yrs)	57.4	11.5	39.0	80.0
Household size(number)	10.0	3.9	3.0	18.0
Years of Experience(yrs)	22.8	15.4	5.0	60.0
Age of Cocoa farm(yrs)	18.7	14.7	6.0	60.0
Farm size(hectare)	3.9	4.6	0.8	24.0

Source: Field Survey data, 2009

The pooled mean table 2 showed that the mean age of cocoa farmers in the two states representing cocoa farmers in south western, Nigeria as 58 years which indicates that most cocoa farmers are old and no longer in their active productive years. Household size indicates most cocoa farming households are large- 9 persons this can pose a threat on their food security and welfare status if the proceeds coming from the small sized cocoa farms cannot feed the dependents sufficiently; the mean years of experience is 26 years while the mean age of cocoa farms in southwestern, Nigeria is 30 years and the mean farm size stands at 4.2 hectares per cocoa farming household.

Table 2 Pooled mean of socio-economic characteristics of cocoa farming households in Ondo and Kwara States, Nigeria

Variables	Mean	Std. Deviation	Minimum	Maximum
Age (yrs)	57.7	13.5	30.0	91.0
Household size(number)	9.4	3.9	2.0	18.0
Years of Experience(yrs)	25.9	14.2	5.0	59.0
Age of Cocoa farm(yrs)	30.6	16.7	6.0	60.0
Farm size(hectare)	4.2	3.7	0.8	15.0

Source: Field Survey data, 2009

Table 3.0 showed that majority of the cocoa farmers are not educated (57% in Kwara and 34% in Ondo state), while 97 and 57% are members of associations in Ondo and Kwara states respectively. Farmers in Ondo State have more savings, acceptable collaterals for getting loan than those in Kwara state. Most of the farmers in Ondo state either purchase or inherited their cocoa farm lands, 52% planted their cocoa on purchased farmlands while 45% planted on inherited lands. In Kwara state, 54% planted on purchased and about 29% planted on inherited farmlands.

Table 3 Household's Socio-Economic Variables

Characteristics	(KwaraState)		(OndoState)	
(i)Education Status of Household Head	Frequency	Percentage	Frequency	Percentage
None	34	60.71	20	34.48
Primary	6	10.71	28	48.28
Secondary	6	10.71	8	13.79
Tertiary	8	14.28	2	3.45
Adult Education	2	3.59	0	0.00
(ii) Membership of Association				
Yes	34	56.67	56	96.55
No	22	19.30	2	3.45
(ii) Those having saving				
Yes	20	35.71	38	65.52
No	36	64.29	20	34.48
(iii) Acceptable collateral				
Yes	20	35.71	27	46.55
No	32	57.14	30	51.75
(iv) Having access to credit				
Yes	20	35.71	28	48.27
No	36	64.29	30	51.72
(v) Land Tenure Holdings				
Inherited	16	28.57	26	44.82
Purchased	30	53.54	30	51.70
Rented	0	0.00	2	3.48
Leasehold	6	10.71	0	0.00
Inherited leasehold	2	3.59	0	0.00
Rented leasehold	2	3.59	0	0.00

Table 4 shows the social capital dimensions of the cocoa farming households in the two states understudied. The overall result shows that generally social capital dimensions are low among cocoa farming households in Nigeria. The overall index shows that only 25 percent social capital exist among cocoa farming households in Nigeria and this is as a result of the low density of membership in association, poor decision making /participation index, poor attendance, low commitments in cash and kind towards whichever association they belonged.

Table 4.0: Summary statistics of social capital dimensions in Ondo, Kwara and Overall

Social Capital dimensions cocoa farming households (%)	Means		
	Ondo State	Kwara State	Pooled Data
Density of Membership (DM)	62.17 (39.57)	33.91 (34.99)	48.03 (39.71)
Heterogeneity index (HI)	56.9 (11.28)	55.90 (13.84)	56.30 (12.59)
Decision making Index (DMI)	6.39 (12.68)	6.41 (6.84)	6.40 (10.15)
Meeting attendance index(MAI)	84.12 (21.12)	66.91 (41.24)	75.52 (33.77)
Cash contribution (CC)	16.07 (21.92)	14.00 (15.05)	15.04 (18.77)
Labour contribution (LC)	19.42 (25.64)	5.05 (12.90)	12.23 (21.47)
Social capital Index (SCI)	30.72 (37.30)	*21.77* (49.85)	25.80 (44.67)

Table 5 profiles the constraints faced by cocoa farming households in accessing credit for their production activities. The disbursement lag of loans rank as the most constraining condition to credit access by cocoa farmers while inadequacy of credit granted as loan rank second on the list, the fear of high interest rate placed as repayment terms rank third while lack of acceptable physical collaterals rank fourth. The result also shows that some cocoa farmers are not constrained this reflect a few percentage of them that are enjoying the benefit of belonging to associations and actively participating in them.

Table 5 Ranking of identified constraints to credit access by cocoa farming households

Constraints to credit access	Frequency	Percentage	Ranking
(1) Long time lag between application and disbursement of credit facility;	26	21.66	1st
(2) Lack acceptable "physical" collaterals;	18	15.00	4th
(3) Inadequacy of credit (not obtaining as much as demanded);	24	20.00	2nd
(4) Fear of high interest rate;	21	17.50	3rd
(5) Problem of both high interest rate and time lag of disbursement.	8	6.67	6th
(6) Problems of both time lag and Inadequacy of credit;	9	7.5	5th
(7) None availability of credit facility (money);	4	3.33	7th
(8) Bureaucratic bottlenecks and process sing;	4	3.33	7th
(9) Lack of guarantors;	3	2.5	9th
(10) No constraint	3	2.5	9th
Total	***120***	***100***	

Table 6 showed the result of the Tobit regression on the actual determinants of credit access to the cocoa farming households. The result showed that amount requested as credit facility is significant ($p<0.01$), years of cocoa farming experience and heterogeneity in association where the farmers belong are significant ($p<0.05$), while cash contribution in association, educational status and presence of collateral possessed by farmers when requesting for credit facilities are significant ($p<0.1$).

Table 6 Determinants of Social Capital and Credit Access for the pooled data

Variables	With multiplicative social capital index	With additive social capital index
Constant	8.4393(1.15)	7.8097(1.02)
Age of household head	-0.1479(-0.87)	-0.2481(-1.59)
Gender of household head	-1.8193 (-0.66)	-6.552506(-1.89)*
Household size	-0.9922(-4.62) ***	-0.7432(-3.30) ***
Literacy	0.0837(0.06)	0.7985(0.51)
Educational status	0.1860(1.88)*	0.1535(1.55)
Years of experience	0.1736 (2.14) **	0.1946(2.38) **
Age of farm (years)	-0.06802(-1.15)	-0.1033(-1.88)*
Farm size (hectares)	0.2887(1.34)	0.1459(0.61)
Amount requested	0.0007(4.07) ***	0.0006(4.03) ***
Disbursement lag	0.0307(0.33)	0.0948 (0.99)
Request for collateral	-3.2422(-1.70)*	-2.2960(-1.29)
Type of collateral	0.5831(1.86)*	0.3788(1.34)
Presence of collateral	2.2031(1.65)	2.2241 (1.84) *
Presence of savings	1.5124(0.47)	1.4782(0.49)
Land tenure	0.4526(1.03)	-0.1620(-0.43)
DM (%)	-	-0.0028(-0.14)
HI (%)	-	0.2175(2.18)**
DMI (%)	-	0.0333(0.52)
MAI (%)	-	-0.0168 (-0.87)
CC (%)	-	0.1749(1.75)*
LC (%)	-	-0.0271(-0.88)
Social capital index	0.04407 (1.45)	-
LR chi^2	63.24	90.16
Prob>chi^2	0.0050	0.0000
Pseudo R^2	0.1865	0.1709
Log likelihood function,	-147.7987	-156.0707

Figures in parentheses are t- values significant at ***1%, **5%,*10%
Dependent variable, Ln Amount of credit accessed.
Number of observations (120)
Source: computer print out

Table 7 showed the result testing whether Social Capital is truly Capital. This is achieved by finding the bi-causal relationship between social capital and credit access using instrumental variable. In this case, a variable which determine social capital but not related to household credit access was used. The instrumental variable (membership of association) is used as a replacement for the social capital index. If social capital is truly Capital, the coefficient of the instrumental variable (membership in association) should be higher than what is obtained for the actual social capital variable in the regression. The instrumental variable estimate (3.066) had a higher explanatory power than the actual social capital estimate (0.04) in Table 7. This implies that the direct effect of social capital outweighs the reverse effect in the explanation of the correlation between the two variables. A reverse causality could have been accepted if there is no improvement or reduction in the R^2 as well as in the instrumental variable estimate. Since there is an improvement on both counts, one can infer the absence of significant reverse causality and thus confirming the exogenity of social capital. A unit increase in the instrumented social capital leads to 3.06 percent increase in credit access for the cocoa farming households while the actual social capital will lead to 0.4 percent increase in credit access.

Table 7 Social Capital and Instrumental Variable Estimation

Variables	Without Instrumental variable	With Instrumental variable
Constant	8.4393(1.15)	8.6437(1.13)
Age of household head	-0.1479(-0.87)	-0.1500(-0.91)
Gender of household head	-1.8193 (-0.66)	-5.4430(-1.50)
Household size	-0.9922(-4.62) ***	-0.8755(-4.39) ***
Educational status	0.1860(1.88)*	0.2377(2.48) **
Years of experience	0.1736 (2.14) **	0.2123(2.61) **
Age of farm (years)	-0.06802(-1.15)	-0.1176(-2.11) **
Farm size (hectares)	0.2887(1.34)	0.3166(1.50)
Amount requested	0.0007(4.07) ***	0.0006(3.88) **
Request for collateral	-3.2422(-1.70)*	-3.8338(-2.12) **
Type of collateral	0.5831(1.86)*	0.4942(1.67)*
Presence of collateral	2.2031(1.65)	2.3675 (1.96) **
Presence of savings	1.5124(0.47)	2.6193(0.93)
Land tenure	0.4526(1.03)	-0.0101(-0.03)
Social capital index	**0.04407(1.45)**	**3.0663(0.76)**
LR chi^2	63.24	65.13
Prob>chi^2	0.0050	0.0000
Pseudo R^2	0.1865	0.1617
Log likelihood function,	-147.7987	-162.2025

Figures in parentheses are t- values significant at ***1%, **5%,*10%
Dependent variable, Ln Amount of credit accessed.
Number of observations (120)
Source: computer printout

Conclusion

The study concludes that social capital has positive influence on credit access and it is an

important factor in improving the cocoa farming households' access to credit in Nigeria;

Most cocoa farming households are still constrained in accessing credit due to lack of physical collateral.

Cocoa farmers are no longer in the active productive years hence, the youths should be encouraged to go into cocoa farming by providing attractive incentives also informs of collateral free-credit based on their social capital status.

Years of experience, presence of collateral, heterogeneity and cash contribution in association are significant determinants of credit access among cocoa farming households in Southwestern, Nigeria

Policy Recommendation

This study hereby makes the recommendation that:

Cocoa farming households should improve on their membership of associations and also improve on cash contributions and heterogeneity in associations as these has been empirically proven to drive access to credit positively.

Timely disbursement of loan to farmers is also recommended based on the time specificity of farm operations.

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Experimental Title: Sustainability of cocoa production by farmers in Nigeria: The case of grass root agricultural financing **(**Obatolu, B.O; Adejumo,M.O and Oduwole, O.O)

Introduction

Cocoa production in Nigeria is by far the most important agricultural tree crop grossing the country an estimated amount of 0.7 billion annually (Obatolu,B.O. *et al.*, 2009). However, the production of cocoa depends solely on the hand of small scale farmers (usually less than three hectares per farm per farmer). (GRO cocoa,2005). It is estimated in Nigeria that cocoa farmers are between 2.5-3.0 million in population (CRIN, 2008).

This industry in the economy has experienced mixed fortunes resulting from the trade dynamics associated with cocoa production and marketing especially from the

international market scenario . (Aigbekaen,E.O. *et a*l.,2006)

From the farmers perspective, the most important factor of production as always been the pertinent issueof agriculture financing (Sanusi, and Lawal 2006). Agricultural financing is highly important to the farmers of which a majority of these farmers are fighting with the issue of poverty. In essence farmers are expected to boost productivity in the face of existing high cost of agricultural input and services such as agro-chemicals,farm implements, labour , and other costs associated with the warehouse and transportation. (Ojo, A.2003)

In other words, information on agricultural finance as well as availability and access to financial aid at the grassroot where production of cocoa is centered and can be said to be inevitable to determine productivity. Agricultural financing in Nigeria can take the shape of formal and informal organizational structures.

Some of the formal organizational structures include commercial, microfinance and agricultural cooperatives and development bank. The informal finance organization includes the licensed buying agent (i.e cocoa buyers), farmers association, cooperatives society, money lenders, family, and friends. (Sanusi and Lawal, 2006)

The basic characteristics of this informal association is such that in some cases no formal documents of membership exist and and if it does it is not rigous , usually money is loaned on the basis of trust , contribution towards the loan is a piecemeal and usually stretched over a long period of time. In otherwords, the condition for and seeking financial aid is very flexible.

However in formal organizational structure, farmers find it to be more complex which requires a more rigorious process of registration in filling documents. In some cases , such organization may only be located in cities or local government headquarters , therefore not reachly accessible to farmers . Though, opportunity of accessing large sum of money may be available and such loan may often require collateral and a number of guarantors. (Oduwole, 2004)

The collateral and guarantors required by a formal financial institution have over the years been an Herculean task which the poor grass root farmers have not been able to overcome . (Oduwole and Akinola 2003)

The informal institutions are well linked, accessible and make available small loans, which can be paid back at the end of the harvest seasons sampling frame work.

A total no of 1,250 farmers were sampled in the study , a multistage sampling procedure was used in the selection of respondent for the study. Two cocoa producing local government were selected in each state taking into consideration high and low productivity level in the local government

This study aims at at investigating the sources of agricultural financing that town producers in Nigeria readily make use of.

Objectives of the study.

1. to identify the sources of agricultural financing to town farmers
2. To analyze the volume of financial aid by organization
3. To compare financial aid across different cocoa producing states

Materials and Method

Study site/location:

The area of study are the 12 out of 14 cocoa producing states identified by (former National Cocoa Development Committee (NCDC)) which includes Ondo, Osun, Oyo, Ogun, Ekiti in the southwestern Nigerian , Kwara & Kogi in North central Taraba &Adamawa in the North Eastern Nigeria, Abia, Akwa ibom, ,Edo south, South Nigeria and cross river in south East Nigeria .

The farmer characteristics vis-à-vis number of years in production population farm size and existing financial institution both formal and informal varies from state to state . the south

western Nigerian had dominated cocoa production since it became a nation al crop (literate) however, imagine cocoa farm of high farmers participation utilizing a great deal of young labor force in the south south and south east**.**

Sampling framework
A total number of 1,250 farmers were sampled in the study; a multistage sampling procedure was used in the selection of respondents for the study. Two cocoa producing local governments were selected in each state taking into considering high and low productivity level in the local government.

Statistical /analytical tool
Descriptive statistics such as means, minimum value, maximum value, variance, standard deviation was used in analyzing the data; graphs were used to display result while ANOVA was used to identify the significant effects of money loan from the financial institute across the state.

Result and Discussion
Table 1 showed the frequency of the table of state according to the no of questionnaires administered

Table 1: Frequency and Percentage Distribution of Responses per state

State	Frequency	Percent	Valid Percent	Cumulative Percent
Abia	100	8.2	8.2	8.2
Akwa ibom	100	8.2	8.2	16.5
Cross Rivers	150	12.4	12.4	28.8
Edo	100	8.2	8.2	37.1
Ekiti	100	8.2	8.2	45.3
Kogi	100	8.2	8.2	53.5
kwara	100	8.2	8.2	61.8
Ogun	100	8.2	8.2	70.0
Ondo	150	12.4	12.4	82.4
Osun	100	8.2	8.2	90.6
Oyo	100	8.2	8.2	98.8
Taraba	14	1.2	1.2	100.0
Total	1214	100.0	100.0	

Source: Field Survey 2008

Table 2: Level of significant for sources of credit by cocoa farmers.

	F	Sig.
Agric finance corporation	.873	.418
Cocoa buyers	84.313	.000*
Farmer's association	1.750	.174
Cooperative society	71.892	.000*
Money lender	31.653	.000*
Other farmers	45.636	.000*
Family	.631	.532

Source: Field Survey 2008

From the analysis of variance, cocoa buyers, cooperative society, money lenders and other farmers are the most significant based on response of farmers to sources of credit, this shows that these sources of loans are readily available and affordable to farmers. It is also important to note that these significant sources of credit are all informal in structure and operation.

Table 3: Showing the variation in amount loaned to farmers

	Minimum	Maximum (₦)	Mean	Std. Deviation
Agric finance corporation	35000	200000	45000	5740.116
Cocoa buyers	25000	270000	134885	27851.013
Farmer's association	25000	30000	25000	1217.160
Cooperative society	30000	100000	29390	11927.836
Money lender	35000	50000	41639	24699.787
Other farmers	25000	90000	16546	7664.997
Family	27000	50000	17875	2521.174

Source: Field Survey 2008

Based on the analysis of the study, results in table 3 showed that the mean of money loaned by cocoa farmers ranged from ₦25,000-270,000 (US $ 165-899). Cocoa buyers had the highest mean of ₦134,885 , while the largest volume of money loaned was from agricultural finance corporation.

Conclusion and Recommendation

From the various sources of credit as shown in the study through which cocoa farmers access credit, cocoa buyers was identified as the source of credit that has the highest patronage by the farmers with over 47% of the respondents.

The role of the cocoa buyers in grassroots agric loan financing is not unconnected to the fact that buyers are willing to collect money loaned to farmers at the end of the production season either in cash or as a form of commodity exchange. The easy access of farmers to cocoa buyers (at their farm levels) and timeliness (taking into consideration pesticides application can make or mar a successful production season) of loan collection by farmers not to mention the ability of the buyers to meet a reasonable amount of money to be loaned by farmers has been a strong point behind the patronage as observed in the study compared to other sources of credit.

The role that the informal financial institution plays in agricultural grassroots financing can not be overemphasized. Their flexibility with respect to loan collection, retrieval and timeliness of the disbursement of the loan is an impetus which more formal financial institutions have to learn from. From this view, these informal institutions (particularly licensed buying agents such as cocoa buyers) should be encouraged by empowering them through the provision of loan incentives by bigger financial institutions.

In addition, the effort exhibited by these informal financial institutions should be encouraged by providing awards and possibly by provision of large revolving loan on commodity basis such as cocoa.

In view of dare needs of loan by farmers, government should however look into commodity trade off on loan basis by farmers to ensure that farmers are not exploited in other words; prevailing cocoa market prices should be used to estimate the value of traded cocoa beans.

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Experimental Title: Cocoa production hecterage determination in Nigeria using Geographic Information System and global positioning system technology. (Obatolu, B.O; Oduwole,O.O and Fademi, O.A)

Introduction

1.0.1. The Cocoa Sector Scenario in Nigeria

Cocoa is the most important agricultural export crop during the 1960-1970 periods, earning a significant percentage of the foreign exchange earning, for Nigeria. The production increased gradually to a peaked of 308,000 metric tonnes in 1970/71 but drastically dropped to 110,000 Mt in 1990/91. This arose because of the diversion of government policy during the 1st, 2nd and 3rd Development plan periods (1970-1985) into petroleum, food production and poor price policy of the Marketing Board which resulted in abandonment of cocoa farms. However the Structural Adjustment Policy period (1988-1993) introducing liberalization resulted in improved pricing and increasing output. The effect of urbanization and government policies and program also impacted on rate of abandonment, rehabilitation and replanting of farms.

In order to boast cocoa production to the level of 1970/71 year and possibly reach a target of 600,000mt, the Obasonjo regime inaugurated the National Cocoa Development Committee (NCDC) in the year 2000 involving all major cocoa stakeholders to look at the modalities and plans to achieve the target. Despite the activities of the NCDC and the colossal amount expended in the last 8 years, farmers are still complaining of inadequate supply of inputs and replanting activities of farmers have been low. Furthermore production figures from the states, NCDC and the international bodies (ICCO and FAO) have been conflicting.

1.0.2. Advances in Technology and Survey Methods.

The world since the development of the microchip used in the computer development for the processing of information has resulted in a revolution in technology providing a means to handle greater volume of data for processing.This information technology race resulted in the development of the Geographic information System (GIS) and the Global Positioning System (GPS). GIS can best be described as a system of information capture, storage, manipulation, analysis and data display using a combination of computer hardware and software by a skilled analyst to assist in a decision making process (Carter, 1989; Huxhold, and Levinsohn, 1995) Legal and political dimensions have been added into the concept of GIS to buttress the relevance in the kind of environment in which it is expected to operate (Maguire, 1991).

The GPS was first introduced by the United States Government (officially known as NAVSTAR GPS) for navigation providing information on position, timing and speed of movement of objects through the use of satellites which orbited the earth. However, in 1983 a presidential order made the services of GPS Satellites free and available to all users anywhere in the world provided they could have access to earth receiving sets. The ease and convenience of use has made GPS a rapidly growing method for surveys considering that it is able to provide geographical coordinates at about 10 feet accuracy.

1.0.3.What Is Global Positioning System (GPS)?

Huffman *et al* (1994) states that The Navigation Satellite Timing And Range Global Positioning System, or NAVSTAR GPS, is a satellite based radio-navigation system that is capable of providing extremely accurate worldwide, 24 hour, 3-dimensional

location data (latitude, longitude, and elevation). The system was designed and is maintained by the US Department of Defense (DoD) as an accurate, all weather, navigation system. Though designed as a military system, it is freely available with certain restrictions to civilians for positioning. The system has reached the full operational capability with a complete set of at least 24 satellites orbiting the earth in a carefully designed pattern. However, the number of earth observation satellites transmitting GPS signals increased to 31 by October 2007 (Encerta, 2008)

1.0.4. GPS Applications to Precision Agriculture and Other Uses.

Many civilian applications benefit from GPS signals, using one or more of three basic components of the GPS: absolute location, relative movement, and time transfer.Field portable GPS receivers are available in the form of handsets from commercial vendors rapidly mapping insect infestations and this data can be accurately communicated to the field manager who may employ a custom spray operator to apply the correct chemicals only where they are needed. In addition, the spray operator will be able to provide a permanent record back to the field manager with GPS data of where and when the treatment took place. Yield monitors will be connected to GPS receivers to map yield. The resultant yield maps will help identify areas of the field requiring different treatments.

GPS sets can be used to map field area by taking several coordinate points of the extent of the farm area and these points can be joined with specialized GIS softwares and the points can be viewed and overlaid, while the area of the extent of the fields or farms are determined.

Parkinson *et al* (1996), Huffman *et al* (1994) and Chang (2006) described the applications areas of The Global Positioning System as thus; while originally a military project is considered a *dual-use* technology, meaning it has significant applications for both the military and the civilian industry.

1.0.5. Geographic Information System (GIS)

Geographic Information Systems are powerful sets of tools used to collect, store, retrieve, transform and display spatial data from the real world for a particular purpose (Burrough, 1986). GIS is a database system in which most of the data are spatially indexed and upon which a set of procedures operates in order to answer queries about spatial entities. It can also be defined as a computerized database for coding, storing and retrieving information tied to a geographic coordinate system (Spanner *et al* 1994).

The Geographic Information System (GIS), with its power and versatility for processing spatial data, has attracted significant attention for the assessment of natural phenomena. GIS provides strong functions both in geo-statistical analysis and database processing. The definition of GIS depicts it as a good tool for environmental researches. The primary function of GIS is the combination and evaluation of different map overlays for the purpose of providing new composite information. In addition, the extension of the analysis to include environmental impact assessment can be easily and effectively performed using GIS.

1.1. **Statement of Research Problem**

A need to generate new and reliable data under current prevailing economic situation on state basis was believed to be important as well as the hecterage on Local Government basis. It is important to note that new states have been created since 1974 and also there has been land fragmentation, loss of cocoa farm lands to fire outbreak and in some cases during the periods of economic downturn in the cocoa sector there was outright abandonment and diversification to other seemingly more resistant crops to the vagaries of weather such as cassava. In addition also is the need to consider the emerging cocoa

farms in the south east and south west Nigeria which have not been surveyed in a scientific manner in the recent years.

1.2 Aim And Objectives Of The Study

1.2.1 Aim

The aim of this study is to estimate the production area of cocoa in Nigeria, making use of Geographic information System (GIS) and Global Positioning System (GPS) technology. The study areas are cocoa producing States and Local Governments recognized in Nigeria.

1.2.2 Objectives

The objectives of the study shall be as follows;

- o estimate area of cocoa farms on local government and state basis
  To generate maps of hectarage and productivity level on local government basis

2.0. Materials and Methods

2.1. The Study Area

The 14 states listed as cocoa producing states in Nigeria is the study area. These states are Kwara and Kogi states in the north-central area, Ondo, Osun, Ogun, Oyo and Ekiti states in the south-western area. Other states include Abia, Akwa-Ibom and Edo in the south-south and Cross-Rivers in the south-east. The set is complete with Taraba and Adamawa in the north-eastern Nigeria. Nigeria has an estimated land area of 923,768 km^2

This cocoa growing area is restricted to latitude 5.09 - 8.49 North and longitude 2.78 - 12.16 East. The vegetation characteristics varies from the tropical rainforest in the extreme south-west and sout-east to the derived savannah in the north-eastern Nigeria. Rainfall is between 1600 – 3600mm/annum and temperatures of 24-34^{0}c.

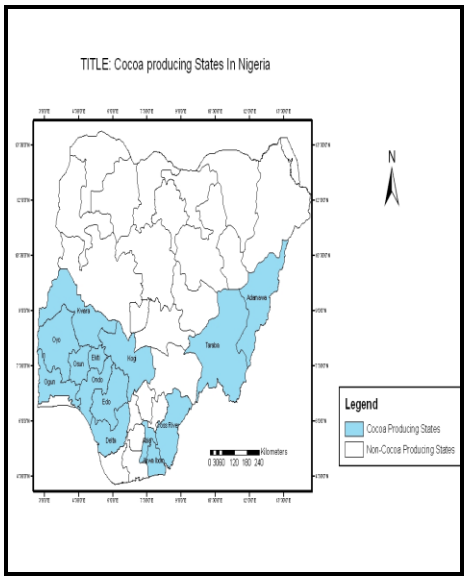

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Fig.1. Map of Nigeria showing Cocoa Producing States

2.2. Data Types, Sources and Acquisition:

The data types fall into two broad categories viz:

***Primary data*:** A survey was carried out to acquire the mass point coordinates and area extent of the Cocoa growing communities in the Cocoa producing states in Nigeria. Other socioeconomic information was also collected in the process

Secondary data: The bulk of the data used for this study were obtained from secondary source as maps and geographic data. See Table 1.1 below:

Type Of Secondary Data	Source And Date Captured
774 Local Government Area Shape file of Nigeria	International Institute of Tropical Agriculture (IITA), Ibadan. 2007
LANDUSE/LANDCOVER satellite of vectorised shape file of Nigeria	International Institute of Tropical Agriculture (IITA), Ibadan. 2006. Mr. Taiwo, Geography Department University Of Ibadan, Nigeria. 2006
Cocoa Production Statistics	Cocoa Research Institute of Nigeria 2002-2007 (CRIN) annual reports

2.3. Software And Hardware Preferences

Software Preference: Three GIS software were depended upon for the processing, manipulation and analysis of data carried out in the study. They include:

Arc View Version 3.2a – This software was utilized because of its capability in both image processing and powerful functionalities in vector data manipulation. A special extension called "Points to Polygon" was added to the extension to join points to become polygons.

ArcGIS Version 9.0- Was used for several spatial analysis such as "clip" and "Overlay" operations of the Landcover/Landuse and 774 LGA shape files.

The other software used in the database design and manipulation was GENSTAT Discovery Edition 3 , MS.Excel (office 2003). GPS Trackmaker for downloading the GPS points from GERMAIN GPS Handsets.

Hardware Preference: The hardware components used were P4 Desktops Desktops with 1G RAM and Computer LAPTOPS PentiumM, 2G RAM ed and a Pentium Four Desktop with a 256MB RAM.

GERMAIN GPS E-TREX handsets were used to collect coordinate ponts of farm locations

2.4. Database Design ad Data Manipulation.

GPS points from Cocoa states were downloa making use of the GPS Trackmaker Software. GPS points were then transferred into MS.Ex Software and saved in DBase format and inputed into the ArcView GIS Software as active themes on State Basis. Contiguous Cocoa mass points were joined representing individual farms or community farms. Such points were joined together to form polygons and average area estimates (q1) and (q2) of Cocoa farms was determined on, community, Local Government Area (LGA) basis respectively. These average estimates (q1) and (q2) were multiplied with the number of farmers on Community and LGA (N1) and (N2) to obtain the Total area of Cocoa farms on Community (Q1) and LGA basis (Q2):

Mathimatical Expression: q1 X N1 = Area of Cocoa Farms on Community Basis (Q1)

q2 X N2 = Area of Cocoa Farms on LGA Basis (Q2)

$\sum$ (Summation)

Q2i……Q2n = National Area Cocoa Farms in Nigeria

Where n = 14 th State

i = 1st State

2.5. Cartographic Model.

A cartographic model is a simplified presentation of the methods of modifying or combining maps according to a consistent set of rules especially in a GIS environment whether in a raster or vector environment. Below (Figure 2) is a graphical representation of the processes carried out during the project.

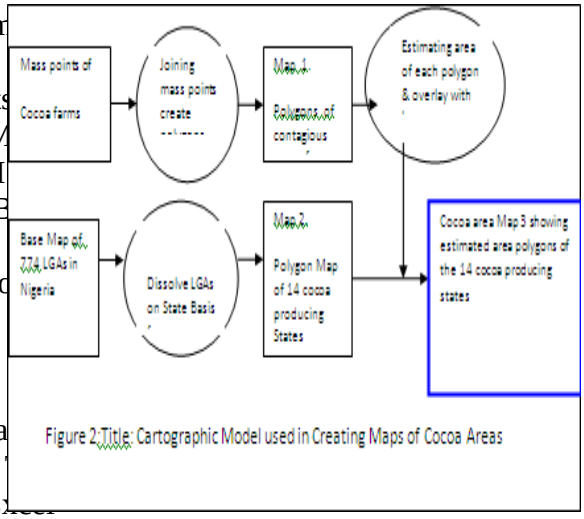

Figure 2:Title: Cartographic Model used in Creating Maps of Cocoa Areas

3.0 Results and Discussion

During the period 2001/2 to 2004/5 the national average yield of cocoa/ha/yr ranged from 0.393 to 0.503 tonnes due to environmental and farm management factors. The estimated cocoa production over the 4 year period is presented in Table 3.1. Total annual production was 251,263 Mt in 2001/2 and this increases to 327,346.7 in 2003/4 but reduces to 321,592.04 in 2004/5. Production classification was done using <2000ha as low, >2000and<10000 as medium and >10,000ha as high producing Local Government Areas.

Table 2. Title: current hectares under cocoa in nigeria

ESTIMATED COCOA PRODUCTION IN NIGERIA					
		2001/2	2002/3 MEAN	2003/4 MEAN	2004/5 MEAN
STATE	CURRENT	MEAN YIELD	YIELD	YIELD 0.512	YIELD 0.503
	HA	0.393 mt/ha	0.421 mt/ha	mt/ha	mt/ha
ONDO	149687	58826.99	63018.23	76639.74	75292.56
CROSS RIVERS	123747	48632.57	52097.49	63358.46	62244.74
OSUN	106111	41701.62	44672.73	54328.83	53373.83
OGUN	80252	31539.04	33786.09	41089.02	40366.76
EKITI	60589	23811.48	25507.97	31021.57	30476.27
EDO	57259	22502.79	24106.04	29316.61	28801.28
OYO	41447	16288.67	17449.19	21220.86	20847.84
KOGI	10200	4008.60	4294.20	5222.40	5130.60
ABIA	4230	1662.39	1780.83	2165.76	2127.69
KWARA	3578	1406.15	1506.34	1831.94	1799.73
AKWA IBOM	1892	743.56	796.53	968.70	951.68
TARABA	200	78.60	84.20	102.40	100.60
DELTA	150	58.95	63.15	76.80	75.45
ADAMAWA	6	2.358	2.53	3.07	3.02
TOTAL	639348	251263.76	269165.51	327346.17	321592.04

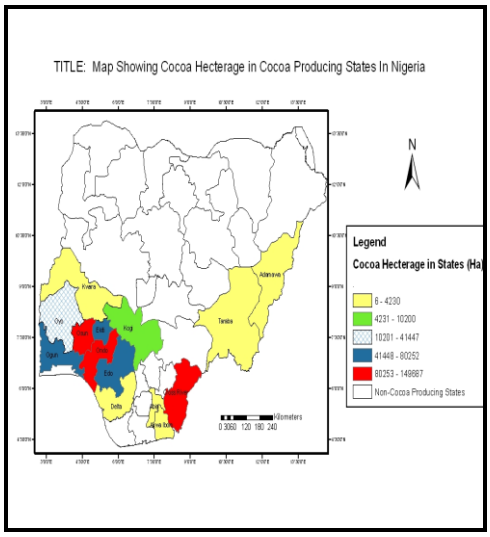

Figure 3: Map of Nigeria showing the Cocoa hecterage in Cocoa Producing States

The result of the GPS and GIS surveyed areas are shown in figure 3, it groups the different levels of hecterage in the 14 cocoa producing states into five. Group 1 consisit of the states with less than 4,230 hectares of cocoa which are Kwara, Taraba, Adamawa, Delta, Abia and Akwa-Ibom. Group 2 consist of state with hecterage between 4,231 and 10,200 Ha which is Kogi. Group 3 is Oyo state with hecterage at 41,447 while Ogun, Edo and Ekiti Stat form group 4 with hecterage between 41448-80252. Group 5 consist of Ondo, Osun and Cross-Rivers with hecterage between 80,253 and 149,687. National total hecterage is 639,348ha with the national mean as 45,668ha and the national standard deviation for cocoa hecterage is 51908. The value of the high standard deviation is as a result of the high disparity in hecterage observed among the cocoa producing states.

4.0. Conclusions and Recommendations

The Global Positioning System(GPS) and Geographic In formation System (GIS) method of area estimation is time consuming in terms of field work required especially for national surveys of this type. It has an exceptional advantage to overcome problems of vegetative signature when crops to be surveyed are overshadowed by bigger forest trees. Though area estimations were made based on the availability of secondary data especially from farmers list needed to compute total cocoa producing area. Equally important to note is that through GPS problems of traditional survey techniques can be overcome.

Results from the study showed that available land varied from 6Ha in Adamawa State to as high as 149,687 in Ondo state. Seven states (Kwara, Abia, Taraba, Kogi, Delta, Adamawa and Akwaibom) have their cocoa hecterage less than 10,200ha, while only three states Ondo, Osun and Cross Rivers have their hecterage over 80,000 but less than 149,687. National total cocoa hecterage is 639,348ha with the national mean as 45,668ha and the national standard deviation for cocoa hecterage is 51908.

Based on the results of the cocoa land area estimates in this study, it is hereby recommended to the National Cocoa Development Committee to rank states

accordingly for the purpose of development initiatives in the sector.

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BIO-TECHNOLOGY PROGRAMME

Experimental Title: Diversity of *Phytophthora* species causing black pod disease of cocoa in Nigeria. **(**Dongo, L.N., Orisajo, S. B., Fademi, A.O. and Adio, S.O.)

Objectives

This study aims to:

1. Assess the extent of intra and inter specific variations using morphological and molecular techniques and to assess the implications of such variations on disease control strategies;
2. To determine the possible relationship between geographic location and these characters.
3. To produce distribution map showing specific *Phytophthora* infected areas.

Methodology

The study was to cover the 14 cocoa producing States in Nigeria but only 7 had been covered successfully due to budgetary restrictions. Naturally infected cocoa pods showing typical symptoms of black pod disease were collected from cocoa farms in Oyo, Delta, Edo, Osun, Ondo, Abia and Cross River states. Isolation of *Phytophthora* species from infected cocoa pods were done by cutting pieces of infected cocoa pod tissue using sterile scalpel, pieces of tissue were surface sterilized in 10% Sodium hypoclorite solution and rinsed in 3 changes of sterile water and were cultured on Potato Dextrose Agar medium amended with 10% lactic acid. The culture plates were incubated at 22 + 2^{o}C in the dark and pure cultures of *Phytophthora* spp were established. Pure cultures were

maintained in agar slants and stored at – 4°C at Pathology lab, IITA.

Result

Phytophthora isolates collected from the 7 states (Oyo, Delta, Edo, Osun, Ondo, Abia and Cross River) have been cultured, grown and maintained. The culturing and purification of the Phytophthora isolates are being kept and maintained at the Pathology laboratory of the International Institute of Tropical Agriculture (IITA) Ibadan.

The morphological characterization of the Phytophthora isolates have also be done.
The research is ongoing.

Conclusion

Phytophthora spp from the 7 states surveyed are established and maintained. Research is ongoing to develop mating types and to carry out molecular characterization. However, there is need to extend the survey to other cocoa producing states to have a well defined map of *Phytophthora* in Nigeria.

Experimental Title: Evaluation of four explants types for production of somatic embryogenesis in tea (*Camellia Sinensis*, var). (Muyiwa A.A. Dongo L.N, Balogun S.T, Adejumo, S. A.)

Objective

The objective of this investigation is to evaluate the potentials of four different explant types to either produce somatic embryos or regenerate into plantlets as potential methods for the rapid multiplication of these commercial tea clones in Nigeria.

Methodology

Plant materials were used as stated below,
Clones used: 318, 68, 143, 236
Explant types: flower buds, Horizontal segments with embryos, vertical segment with embryos, and immature leaf explants.
Nutrient media used: Medium specifically developed for cocoa was modified.
Explants types were surface sterilized by immersion in 70% ethanol for three minutes followed by another two minutes in a solution of commercial laundry bleach which was diluted to contain 1.0% sodium hypochlorite to which has been added 0.1% of Tween 20 to serve as surfactant.

Culture media: Embryo Development Medium (ED) and primary callus growth (P.C.G) medium specifically developed for cocoa was modified and adopted. The primary callus growth media consisted of 100ml/L DKW macro A, 10 ml/L DKW macro B, 10ml/L DKW, micro, 1ml/L DKW vitamins and 20g/L glucose.
The embryo development (ED) comprised of 1g/L DKW Basal salt medium, 1g/L glucose, 20g/L sucrose, and 2.2.g/L Phytagel. 1 litre of medium were prepared, the pH was adjusted to 5.7 + 1 prior to autoclaving and incorporation into phytagel. Medium was dispensed and autoclaved at 121^0C for 20 minutes after which they were stored to cool and solidify. The cultures were stored in total darkness. The treatment consisted of three replicates and was repeated six times.

Results and Discussion

In vitro morphogenesis response observed within 55 days on primary Callus growth medium ranged from whitish to brownish callus from staminode and immature leaf explants of clone 236 and 143 respectively (fig I).

Fig 1 Callus induction, brownish and whitish callus formation from staminode explant from clone 236.

At 24 weeks on the Embryo development medium, primary somatic embryos were evident from the staminode and immature leaf explant of clones 236 and 143 (Fig 2).

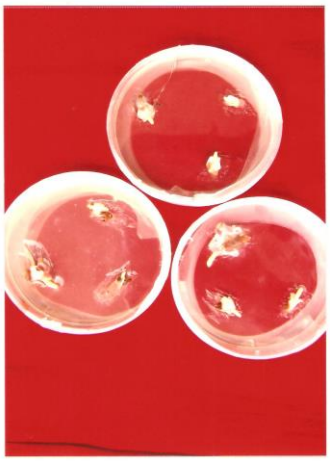

Fig 2 primary somatic embryos from staminode and immature leaf explants of clone 236 and 143.

At 28 weeks. Secondary somatic embryos developed directly from Horizontal and vertical segments with embryos from clones 318, and 68 (fig 3).

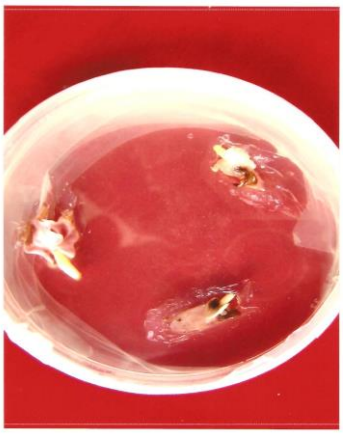

Fig.3. Secondary somatic embryos from horizontal segment from clone 318.

These primary and secondary embryos were observed in varying degrees within cultures. However the primary and secondary embryos which were highly embryogenic remained pinkish to yellowish in colour, and were observed from clone 236 and 143 fig: 4

Fig.4. Synchronized Secondary somatic embryo from clone 143

These secondary somatic embryos remain dormant without further growth. The staminode explants could also not go beyond primary embryogenesis.

In general, the Horizontal and the vertical segments with embryos produced well

synchronized primary and secondary somatic embryos than embryos produced from staminode and leaf explants. Of all the clones tested, clones 236, and 143 had the highest regenerative potential than the remaining two genotypes, (Table 1) showed in vitro responses of the tea explants within 55days and 28 weeks.

Table 1 .In Vitro response of tea explants within 45 and 28 weeks

Explants types	xx % Survival	XNM	Morphogenic responses	Days
Staminode	60	30	Callus formation /primary embryos	55/24wks
Leaf	60	25	Callus formation /primary embryos	55/24wks
Vertical segment with embryos	75	45	Primary/secondary embryos	28wks
Horizontal segment with embryos	70	35	Primary/secondary embryos	28wks

Xx – Explants enlarged turned pink and became dormant

xnm- Number showing morphogenesis

Many parts of tea plant, particularly the embryo and seedlings can be cultured and made to grow in-vitro when the right choice and combinations of explants, nutrient medium constituents and culture conditions give the proper stimulus. As these results have shown their continued growth into plantlet is still a major problem, unlike in most other tree crop. This sudden cessation of growth after somatic embryogenesis in tea advantageously could in the near future facilitate encapsulation in the production of artificial seeds by coating. With these achievements seeds produced through self fertilization which normally would have either aborted or would have been incapable of natural germination can now be salvaged by culturing them in vitro. This would then accelerate the attainment of homogenous population and consequent rapid multiplication of such populations direct from seeds. At present modern tea plantations are established from rooted cuttings so as to have a homogenous plantation of tea bushes.

Conclusion

Somatic embryos from these four explants types have been extensively studied. Future efforts would be directed towards plantlet regeneration and also to ensure the continued growth of these dormant tea embryos in vitro into plants. Currently, effort is ongoing to stimulate their further growth development.

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CROP PROCESSING UNIT PROGRAMME

Experimental Title: Mycoflora and Nutritional Components of Cocoa Powder Samples in South West, Nigeria. **(**Jayeola, C.O)

Abstract: Food-borne infections and intoxications remain relevant sources of illness, hospitalizations, and even death. This study is of public health importance because it determines the food safety of cocoa powder (CP) that is consumed as well as been used as raw materials for producing cocoa-based beverages in Nigeria.
A total of 360 samples of 24 brands of CP were analysed. The viable mycoflora isolates were identified using cultural and microscopic features. The pH. Proximate and mineral was determined using recommended standard methods by Association of Official Analytical Chemists (AOAC). Student t-test was employed in the statistical analysis of the data. The result showed variation in percentage of fat, protein and carbohydrate content as well as pH values from one CP to another. The pH values ranged from 6.4 to 7.4 while the moisture content of the CP was between 0.80 and 1.86%. The CP samples were found to be rich in magnesium, iron, sodium, potassium and carotenoids but deficient in vitamins.

Introduction: The mycroflora and the intrinsic factors that might contribute to the spoilage or deterioration of the powder are very important in order to ensure food safety.
Food safety is usually determined by the absence or presence of pathogenic organisms, or their toxins, and the number of pathogens, with their expected or destructive agents (Ogunledun, 2007). The level of spoilage microbes reflects the microbial quality, wholesomeness, of a food product as well as the effectiveness of measures used to control or destroy such microbes (Pierson and Smoot, 2001).

Food borne disease and microbial spoilage of food result from the failure of or inability to control micro organisms at one or more stages of food chain, from raw material production to consumption of the final product. Specifically, the microbiological tools are used to assess the safety of food, adherence to Good Manufacturing Practices (GMPs), the keeping quality (shelf life) of certain perishable foods and the utility (suitability) of a food or ingredient for a particular purpose (NRC, 1985). There has been great awareness on the health benefit of cocoa especially in treating hypertension and diabetics, (Olubamiwa, 2007) also there is an increased public health concern on the quality of these products especially those packaged as eruku oshodi, as food poison outbreaks have often been traced to the consumption of unhygienically handled food products (Ogunledun, 2007; Chukwuka, 1997; Badru, 2005).

Materials and Method:
Proximate analysis was carried out according to the method of AOAC (2000)

Yeast and mould counts were determined using McFaddin (1980) methods.

Direct plating of the samples on agar media out by aseptically plating 1g of each sample on potato dextrose agar (PDA). The plates were incubated under room conditions ($28+2^0$C) and examined after 7 days under a stereoscopic binocular microscope for the presence of fungi.

Colonies of fungi that appeared on agar plates were repeatedly sub cultured on fresh PDA until pure culture of each isolate was established. Identification of fungi was by observing the growth habits and morphological characteristics under a wide

binocular microscope. Wet mount of hyphae/asexual structures stained with lactophenol in cotton blue were viewed under compound microscope and identified with reference to standard texts (Barnett and Hunter, 1987). Characterisation of the Fungi was done using War cup (1957) method. It was based on the colour of the colony, appearance, conidiophores, mycelium, arrangement of conida on sterigmata. The pure culture of fungi got was prepared on a clean glass slide and stained with cotton blue in lactophenol. Observation was done under X40 oil immersion objective lens.

RESULT: Table 1 depict the inherent properties of the cocoa powder brands and this is the nutrient composition comprising % moisture, % fat, %protein,%ash, %carbohydrate and their respective energy values. There is significant difference ia all the parameters expects for moisture. The cocoa powder is nutritious enough to support the growth of microbes when the conditions are favorable.

The cultural and microscopic features of fungi isolates were shown in table 2 with *Aspergillus niger* and *Saccharomyces cerevisae* having isolation rates of 25% each, *Penicillum chrysogemum* 16.7%, *Aspergillus melleus* 8.3% and *Aspergillus ochraceous* 2.5%. The presence of *Aspergillus spp* is the most prominent organism.

Table 1: Proximate analysis of cocoa powder brands

NO	CODE	NO MOISTURE (%)	FAT (%)	PROTEIN (%)	ASH (%	CHO (%)	RNERGY (cal/g)
1.	CIL	1.1ONS	11.2lb	20.85c	5.10b	58.74b	502.65
2.	FRL	1.44	10.50c	20.10c	6.22a	59.74a	413.86
3.	IOCP	1.12	12.01a	18.92	4.88c	60.01a	424.05
4.	MNL	1.78	10.21a	22.01a	5.84b	58.16bc	412.57
5.	ONP	1.35	10.25c	22.54a	5.55b	58.31b	415.65
6.	SCP	1.26b	11.12b	21.50b	4.26c	58.86b	421.52
7.	SF	1.65	10.25c	20.10c	6.45a	58.55bc	406.85
8.	FCP	0.84	11.50b	22.10a	6.15a	56.41cd	417.54
9.	PNL	2.51	10.45c	20.80c	5.24b	58.00c	409.25
10.	MTIL	1.66	10.33c	21.25b	4.68bc	59.08a	414.29
11.	NNP	1.15	11.43b	21.10b	5.40b	57.92c	418.95
12.	CNL	1.22	11.50b	20.55c	6.10a	56.63d	410.61
13.	NBC	1.68	11.01b	21.25	5.25b	56.81d	411.33
14.	EFCO	1.30	12.72a	20.95c	5.15b	56.88d	425.80
15.	CCP	1.68	10.45c	21.00b	4.90b	58.97b	413.93
16.	BAAK	1.45	11.40b	20.10c	4.26c	56.29d	408.16
17.	SUMAL	1.62	11.25b	21.15b	4.92bc	57.06c	414.09
18.	CRIN	0.92	10.40c	22.10a	5.28ab	58.50b	416.00
19.	LI	1.86	12.5a	21.22b	6.40a	54.02c	413.46
20.	L2	1.45	11.55b	20.20c	4.90bc	55.20c	402.85
21.	L3	1.84	10.20c	22.01a	5.29ab	55.66c	402.48
22.	L4	1.32	12.10a	21.0la	6.02a	54.55f	369.12
23.	L5	1.92	11.50ab	21.25b	5.50b	54.66f	410.68
24.	GCP	0.80	11.56ab	22.00b	5.96a	58.87b	427.48

Value followed by the name alphabet in the column are not significantly different at $p<0.05$ NS = Not significantly different

Table 2: Occurrence of mycoflora in cocoa powder

Cultural and Microscopic Features	Possible Isolates	N	n	%
Blackish-brown often with yellow mycelium. Reverse greenish-yellow to yellow-or Its head globose, splitting with age. Its metulae is long closely packed and brownish.	*Aspergillus niger.*	12	3	(25)
White to yellow mycelium. Yellow, buff to Brown sclerota. Pale yellow gold or cream Present.	*Aspergillus melleus*	12	1	(8.3)
Yellow-buff coloured colonies, small and Neatly smooth conida, pink to purple sclerotia. Uncoloured, yellow or dull red exudates when Present.	*Aspergillus ochraceus*	12	3	(2.5)
The texture is silicate and velvetious. Bluish-green to (dark) green Observed. Its has a short smooth strupe. The Penicillin is terverni-culate, phialides ampulli form. Collula very short, both Divergent and appressed Branched. The conidia is allipsoidal to spherical, Smooth and greenish.	*Penicillium chrysogenum*	12	2	(16.7)
It is creamish in colour, obverse and oval in Shape (spore). The cellular is smooth and Very small. It has branched cells (spores)	*Saccharomyces cerevisiae*	12	3	(25)

N = Number of samples investigated

n= number with positive culture
% = Isolation rate

Conclusion: The different cocoa samples were analysed for microbial contaminants as a means of ensuring food safety. More so, microbiological criteria of food are used to distinguish between acceptable and unacceptable food product, whereas the nutritional analyses provide background knowledge on the component of foods and this is to ensure the quality of the food.

The presence of *Aspergillus species* and *Penicillium chrysogenum* a lipolytic and toxigenic moulds (Uraih and Ugbadu 1980) should be viewed with great concern since in recent year food poisoning outbreak have been traced to contamination of food products by these organisms (Ormy and Norvorming 1968). The presence of mould is an indication that most of these food borne fungi exhibit the potential to produce toxic metabolites.

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Experimental Title: Physicochemical characteristics of tea (*Camellia sinensis*) seed oil (L.E Yahaya)

Introduction: Vegetable oils represent important raw materials that are being used in 113the chemical industry. With the escalating prices of petroleum resources coupled with its finite and non renewable nature, researcher's interest has been rekindled in the development and utilization of alternative renewable feedstock.

Tea (*Camellia sinensis)* seed oil is one of such vegetable oil that has been underutilized and exploited in major part of the world, especially Nigeria. In Nigeria, for example, tea cultivation is mostly practiced in the upland of the Mambilla plateau and production figure is enormous thus contributing to the world production figure of 3.6million tones per annum (FAO, 2006).The implication of this is that the seed resulting from the cultivation of tea is often regarded as byproduct.

Materials and Methods: Tea seeds used for this study were obtained from the Mambilla station of the Cocoa Research Institute of Nigeria. Laboratory grade chemicals such as hydrochloric acid, potassium hydroxide, potassium iodate, sodium thiosulphate, starch, iodine monochloride, potassium iodide etc

employed for the characterization of the oil were obtained from the local market. The oil content was determined according to the method of AACC 30-25 (AACC, 1991). The seeds were thoroughly dried to low moisture content and the oil was expressed using soxhlet extractor and n- hexane as the extracting solvent. In this case, known weight of the finely ground tea seed was introduced into a thimble in a soxhlet apparatus and extraction was carried out for 8 hours under heat supply. The solvent was then removed using rotor vapor and extraction were performed in replicate the oil yield was calculated based on weight difference as follow:

Oil yield (%) = weight of oil/weight of sample × 100

Physicochemical characteristics: The physical and chemical characteristics of tea seed oil (TSO) like color, specific gravity, acid value, iodine value, hydroxyl value, saponification value were determined using IUPAC standard methods (Paquot and Houffenne, 1987). These were performed in replicate.

Fourier Transform Infrared, FTIR spectroscopy: Infra red spectra of TSO were recorded using an impact 400D Nicolet FTIR Spectrophotometer. Thin film of TSO was spread on NaCl plate and the FTIR spectrum was recorded in the range of 4000-400cm^{-1} wavelength.

Gas Chromatography: The fatty acid profile of TSO was determined using its FAME. This was recorded using the Gas chromatograph (shimazdu 5020). The fatty acids composition of the oil was determined by using AOCS official methods Ce 1-62, which constitute a base- catalyzed methylation reaction.

Results and Discusion

Table 1. Physicochemical characteristics of TSO

Parameters	Value
Appearance	Golden yellow
Color (Lovibond)	1.1R, 7.8Y
Specific gravity (29^{0}C)	0.891
Acid value (mgKOH/g)	23.69
Saponification value (mgKOH/g)	186.5
Hydroxyl value (mgKOH/g)	212.06
Iodine value (gI$_2$/100g)	74.23

Results are mean standard deviation of triplicate determinations.

Table 2. Fatty Acids Composition of Tea Seed Oil

Fatty Acid	%
Saturated	
Palmitic (C16.0)	21.88
Stearic (C18.0)	03.76
Total	25.64
Unsaturated	
Oleic (C18.1)	60.05
Linoleiec (C18.2)	13.01
Linolenic C18.3)	00.20
Total	73.26
Others	01.07

Results are mean standard deviation of triplicate determinations.

The physical and chemical characteristics of TSO is shown in Table 1

From the Table 1, it is evident that TSO is a golden yellow colored liquid; the lovibond index (1.1R, 7.8Y) confirms this. The implication of this is that tea seed oil could be suitable in application where bright color is a requirement. The specific gravity obtained is in agreement with values for other known vegetable oils (Pryde, 1979). The saponification value obtained is an indication that tea seed oil is suitable for soap production by alkali hydrolysis and this is similar to coconut oil which is employed for similar purpose (Gerbig and Ahmed, 2004). Tea seed oil has a low iodine value indicating that it is non-drying.

Gas Chromatography Analyses: The fatty acid profile of tea seed oil is shown in Table 2. From the table, it is obvious that TSO comprises essentially approximately 26% saturated fatty acids and 74% unsaturated fatty acids. The saturated fatty acids include palmitic and stearic acid while the unsaturated fatty acids include oleic, linoleic and linolenic. From the result, it is evident that oleic acid (C18:1), a monounsaturated fatty acid is the dominant fatty acid hence the low iodine value.

The amount of various fatty acids in vegetable oils can serve as a guide in identifying the oil, hence the quality and purity of such oil could be guaranteed especially for industrial applications (Oil and Color Chemist Association, 1991). Oils containing fully saturated acids tend to solidify in cold environment, thus limiting their low temperature functionalities (Aparicid, and Aparicio-Ruiz, 2000).Tea seed oil with its unique high monoene and low percentage of saturated fatty acids could make it a promising candidate for oleochemical applications such as biodiesel fuel, biopolymers and biolubricants besides its use as edible oil.

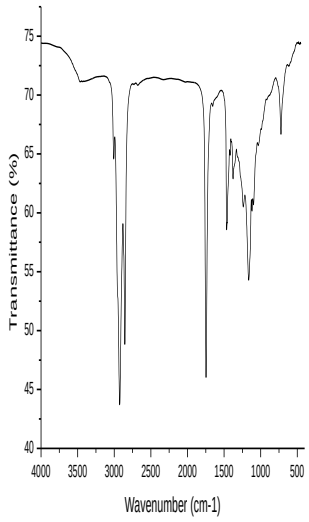

Fig.1 FTIR of Tea seed oil

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Experimental Title: Physicochemical evaluation of biscuit (sweet cookies) supplemented with cashew apple powder. (Ogunwolu, S. O. and Ogunjobi, M. A. K.)

Introduction: Cashew apple is a climacteric fruit, thus exhibit a pronounced increase in respiration coincident with the on set of ripening, which leads to very short storage life. The drying of tropical fruits can be an excellent alternative to make their shelf-life longer and commercialization easier. In this work, cashew apple produced earlier as dehydrated fruit powder was used in the formulation of Cookies biscuit with the objective of finding a viable alternative use for the wasting cashew apple.

Objectives: This study was to evaluate the physical and chemical qualities of biscuit (sweet cookies) supplemented with cashew apple powder.

Materials and Methods: The cookies were made according to the AACC (2000) 'sugar-snap cookies' method No 10-50D with some modifications. In all cases, the products contained 5g, 10g, 15g, and 20g/100g of cashew apple powder in relation to wheat flour content. Control sample was produced using 100% wheat flour. Ingredients were

blended in a mixer and kneaded. The dough was then shaped into cookies and baked. Baking was done in an electric oven at 150^{O}C for 15 mins. Once baked, the cookies were allowed to cool, packed in polypropylene container and stored. Table 1 shows the composition of the cookies biscuit supplemented with different percentages of cashew powder, and the control sample.

Determination of physical properties of cookies: Cookies Diameter (D) and Thickness (T) were determined using a Vernier calliper, while cookies weight was determined using an electronic weighing balance. Spread was calculated as D/T x 10 (Akubor, 2004a).

Determination of chemical properties of cookies: All the chemical properties of the cookies were determined according to the method of AOAC (2000).

Results and Discussions: Table 2 shows the physical properties of the 4 cookies supplemented with cashew apple powder and the control samples. There was a significant difference ($p \leq 0.05$) between control sample and cashew apple powder supplemented samples in terms of thickness, diameter and spread ratio. Cookies thickness and diameter increased slightly as the proportion of cashew apple powder increased. The lower diameter value of cookies made from 100% wheat flour compared to CAP supplemented cookies may be due to high gluten content of wheat flour (Fuhr, 1992) which formed an elastic network (Chris, 1987) capable of holding the gluten strands such that during baking, there is contraction in the product structure, hence lower diameter value. There was no significant difference ($p \geq 0.05$) in weight of the control and supplemented samples. The increase in protein, fat, ash and moisture of cookies with increasing supplementation of CAP (Table 3) could be attributed to addition effect. In a similar study, Akulbor, (2004b) observed the same increase when soybean flour was supplemented to maize flour for biscuit production. The slight increase in moisture content of cookies as the proportion of CAP increased could be attributed to high sugar content of CAP which made the cookies to be hygroscopic. However the moisture content of all the cookies produced was within the safe limit for adequate storage life of the cookies (Kure et al, 1998). The higher crude fibre of the CAP supplemented cookies compared to 100% wheat flour cookies could be as a result of the higher crude fibre content of CAP compared to wheat flour. This is an additional nutritional benefit of CAP supplemented cookies, since crude fibre aid the digestive system of human (Ihekownye and Ngoddy, 1985). The higher ascorbic acid of the CAP supplemented cookies was as a result of the ascorbic content of cashew apple juice, which is about 203.5mg/100ml (Akinwale, 2000), and the use of whole cashew apple for the production of CAP (Ogunjobi and Ogunwolu, 2010).

Table 1: Cookie composition supplemented with different percentages of cashew apple powder

Ingredients (g/100g)	Levels of supplementation				
	Control	5g/100g	10g/100g	15g/100g	20g/100g
Wheat flour (g)	225.0	213.8	202.5	191.3	180.0
Sugar (g)	100.0	100.0	100.0	100.0	100.0
Invert sugar (mL)	20.0	20.0	20.0	20.0	20.0
Vegetable fat (g)	60.0	60.0	60.0	60.0	60.0
Water (mL)	40.0	40.0	40.0	40.0	40.0
Baking powder (g)	4.5	4.5	4.5	4.5	4.5
Salt (g)	2.1	2.1	2.1	2.1	2.1
Cashew apple powder (g)	-	11.3	22.5	33.8	45.0

Table 2: Physical properties of Cookies supplemented with cashew apple powder

Physical properties	Levels of supplementation				
	Control	5g/100g	10g/100g	15g/100g	20g/100g
Weight (g)	7.05[a]	6.60[a]	6.73[a]	6.80[a]	6.85[a]
Thickness (mm)	40.00[a]	35.00[b]	35.50[b]	35.80[b]	35.85[b]
Diameter (mm)	30.80[b]	35.50[a]	35.60[a]	35.80[a]	35.90[a]
Spread ratio	7.70[b]	9.80[a]	9.80[a]	9.90[a]	10.00[a]

Values with the same superscript and in the same column are not significant different $p \geq 0.05$

Table 3: Chemical properties of cookies supplemented with cashew apple powder

Chemical composition	Levels of supplementation				
	Control	5g/100g	10g/100g	15g/100g	20g/100g
Moisture (%)	11.5[a]	7.8[b]	7.8[b]	7.9[b]	7.9[b]
Protein (%)	12.5[a]	8.5[b]	8.7[b]	8.7[b]	8.9[b]
Fat (%)	26.5[a]	3.4[b]	3.6[b]	3.7[b]	3.9[b]
Ash (%)	1.6[b]	2.5[a]	3.0[a]	3.5[a]	3.7[a]
Crude fiber (%)	1.0[b]	1.7[a]	1.9[a]	2.1[a]	2.5[a]
Carbohydrate (%)	73.3[a]	60.5[a]	64.3[a]	67.1[a]	69.5[a]
Reducing sugar (%)	0.2[b]	0.5[a]	0.5[a]	0.7[a]	0.9[a]
Non-reducing sugar (%)	1.2[b]	1.8[a]	2.0[a]	2.4[a]	2.7[a]
Total sugar (%)	1.4[b]	2.3[a]	2.5[a]	3.1[a]	3.6[a]
Titrable acidity (%)	2.0[b]	2.9[a]	3.3[a]	3.6[a]	3.9[a]
Total soluble solid (%)	20.0[b]	36.5[a]	37.0[a]	38.0[a]	40.1[a]
Ascorbic acid (mg/100g)	4.0[b]	8.0[a]	8.8[a]	9.5[a]	10.4[a]
pH	4.6[a]	5.0[a]	4.9[a]	4.7[a]	4.7[a]

Values with the same superscript and in the same column are not significant different $p \geq 0.05$

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Experimental Title: Effect of wet and dry processing methods on the chemical composition of green coffee (*Coffea canephora*)**. (**Ogunjobi, M.A.K, Ogunwolu, S.O and O. Olubamiwa)

Introduction: Coffee belongs to the botanical family Rubiaceae, which has some 500 genera and over 6000 species. The two most important commercial species cultivated in Nigeria are the highland coffee (arabica coffee) which account for only 4 % and the lowland coffee (Robusta Coffee) which

accounts for about 94% of coffee export. Though arabica coffee is of the greatest economic importance in the international market, but robusta coffee contains about 40–50 percent more caffeine than arabica. For this reason, it is used as an inexpensive substitute for Arabica in many commercial coffee blends. Good quality robusta are used in some *espresso* blends to provide a better foam head and to lower the ingredient cost.

Essentially two main post-harvest processes are applied to coffee cherries, namely the dry process and the wet process. Dry processing consists of drying the whole cherry and then mechanically removing the dried outer parts, whereas wet processing consists of removing the fresh parts by pulping, fermentation and subsequent washing steps before drying . Due to the different conditions prevailing during these treatments, biochemical and physiological changes occurring during post-harvest treatment could differ resulting in different cup quality. Screening of literature revealed that there is no information on the effect of processing methods on chemical composition of green coffee in Nigeria.

Hence, the objective of this study was to determine the chemical composition of wet and dry processed green robusta coffee (*Coffea canephora*) in Ibadan.

Materials and Methods: The experiment was carried out at CRIN Headquarters, Ibadan. Robusta coffee berries were harvested from the coffee plantation of the Institute. After harvest, fresh cherries were divided in two parts for well-controlled standard dry and wet

processes for the production of green coffee [3,4].

Chemical Analyses: The moisture, caffeine, lipids, proteins, carbohydrates, trigonelline, chlorogenic acids, organic acids, ash, and pH and acidity were determined according to AOAC methods (1990).

Results and Discussion:

Tables 1 compare the chemical compositions of Robusta coffee processed in parallel by dry and wet processes. As suggested in previous works by scientists, post harvest process affects the balance in low molecular weight compounds, key precursors of coffee aroma and flavours.

Table 1: Chemical composition of dry and wet processed robusta coffee (expressed as a percentage of the dry basis)

Parameters	Dry	Wet
Moisture	13.08_a	11.42_b
Caffeine	1.84_a	1.84_a
Lipids	10.80_a	11.50_b
Proteins	12.12_a	12.13_a
Carbohydrates	47.01_b	48.50_a
Trigonelline	0.61_a	0.58_b
Chlorogenic acids	9.24_b	10.48_a
Organic acids	1.78_a	1.59_b
Ash	4.64_a	4.38_b
Ph	6.26_a	6.01_b

Notes: Values are means of three replicates; sample means with the same alphabets along the rows are not significantly different at $p<0.05$

Applying wet process on *Robusta* coffee resulted in higher levels in carbohydrates, lipids and chlorogenic acids and also resulted in lower levels in Trigonelline, organic acids, ash and pH. Applying either wet or dry post-harvest processes had almost no influence levels in caffeine and protein.

Globally, dry processed coffees were richer in metabolites from degradation mechanisms (e.g. free glucose and fructose resulting from polysaccharide hydrolysis, quinic acid from chlorogenic acid splitting, phosphoric acid from phospholipids). Degradation reactions could be due to the overall slower drying kinetics of cherry coffee (i.e. dry process) compared to parchment coffee (i.e. wet process). Degradation phenomena could also explain the lower chlorogenic acid level of dry processed coffees. Higher value for ash in dry processed coffee compared to wet process may be due the transfer of minerals from the fresh parts to the bean core upon drying,

whereas wet process could favour the removal of minerals during the washing step.

Conclusion

In conclusion, post-harvest process has a clear impact on the low molecular weight components present in green coffee. Dry process appears to favour degradation mechanisms responsible for a change in the balance of the key aroma precursors. Wet process could favour the removal of precursors, which contribute to the strong *Robusta* character. However, from the present data wet process does not seem to initiate strong physiological changes.

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Cocoa Research Institute of Nigeria, Ibadan

Experimental Title: Design and construction of a 200kg/batch fermentation equipment for Cocoa. (A.S. Mofolasayo)

Objective: To design and construct a 400kg/batch wet bean fermentation box for cocoa

Materials and Method

The functional requirements of the fermentation tray are:

A rigid frame

Four boxes with rolling mechanism

Agitators

Sweating collector

Description and Construction of Component Parts

Frame: The frame is made of 2-inch angle iron with dimensions 1766mm × 1222mm × 1395mm. the frame is divided into two major compartments with each containing two boxes/trays. Each box sits on two rails of angle iron, one above and the other below. There were four trays in all. The rails were welded at right angles to the six uprights or columns. At the base of each column was welded a 100mm ×100mm ×2mm thick mild steel sheets to serve as flanges to which rollers were attached to facilitate easy movement of the equipment.

Boxes: The boxes were made of 2mm stainless steel sheets. The dimensions of each of the four boxes were 1017mm × 86mm × 20mm. The bottom of each box was perforated to allow the emulsified pulp to drain out during the fermentation process. To the front of each box was welded a handle

made of a short length of 2-inch angle iron to facilitate the easy placement, removal and agitation of the both wet and fermented bean. Furthermore, at the base of each tray were attached four 10mm diameter ball bearings each to facilitate the easy displacement of the tray during agitation to facilitate the turning of the wet beans during the aerobic stage of the fermentation process

Agitators: The agitator comprised four pieces of angle iron, each hung above each of the four boxes. The angles carried carefully curled agitating mechanisms made of 3mm thick stainless sheets. The agitators were welded to the angle iron supports above the tray and arranged such that during forward movement of the tray the wet cocoa beans is displaced to one side by the outermost agitator while the next or alternate agitator displaces the wet cocoa bean back to the original position. This arrangement ensures the wet beans do not lump nor cluster together while leaving empty patches or strips in the mass.

Collector: The collector was made of 1.5mm thick stainless steel sheet. It was attached to the bottom of the frame such that it slopes towards the collection point. The drain from the emulsified pulp drops onto this tray and is collected at the discharge. Plate1 shows the fermentation equipment.

Plate1: The fermentation equipment

Results and Discussion

Preliminary Evaluation: In order to observe the effect of the construction and material on the quality of fermentation, about 40 kg wet cocoa beans was introduced to one of the boxes. The beans were placed such that it only occupied one third of the length of tray in to ensure a greater depth because of the small quantity of beans involved. The top of the tray was covered with banana leaves and left to ferment for 5 days without agitation. After fermentation the beans were dried to safe moisture level for storage. Inspection of the dried product shows appropriate browning and the chocolate flavor desirable in dry cocoa beans. It is worth mentioning that the test is not elaborate and qualitative enough owing to lack of adequate cocoa beans as the test was conducted towards the end of the light cropping season. The main objective of the preliminary test conducted was to ascertain the possibility of the construction material to substitute the less durable wooden box currently in use. The preliminary results proved satisfactory because fermenting in the equipment the not adversely affect the colour of the dried beans.

Conclusion

A 400 kg / batch fermentation tray for cocoa was designed and constructed. The preliminary results showed that the colour of the dried bean obtained from fermenting wet cocoa bean in one of the trays was satisfactory. However more elaborate tests should be conducted with all trays filled to capacity with the effect of agitation via the agitation mechanism considered. Also anthocyanins content, a good marker for fermentation of cocoa beans should be investigated to provide a more qualitative base.

Experimental Title: Antioxidative, antifungal, nutritional and preservative effect of cocoa pod husk, kola pod husk and firewood on smoked tilapia (*Oreochromis niloticus)*. (Adebowale, B.A, Ajani, F., Olubamiwa O. and Dongo, L.N.)

Introduction: The main source of domestic fish production in Nigeria is by the artisanal fishermen who dominate the entire Nigerian inland capture fisheries (Ogali, 1994). Available data show that the artisanal fishermen contribute more than 95% of the local fish production and over 66% of the total fish supply to the nation between 1971 and 1980 (Eyo 1992). The artisanal fishermen lose a huge percentage of their total catch to poor handling and lack or inadequate processing techniques. According to Eyo, (1977), when fish are caught alive, they are left at the bottom of the Canoe often in warm and dirty water under intense sunlight. These fish consequently struggled till death. The condition known as Asphyxia. As reported by Eyo,(1983), fish mongers are readily available at different landing sites in Kainji to quickly buy off the catch from fishermen and display it raw for sale to consumers. In the processes however, fishermen and fish mongers often expose fish to infestation by blow flies which lay large numbers of eggs in the gills and gut regions of the fish(Eyo 1976). Apart from this, other biochemical changes should have occur during the delay before processing. In fatty fish for instance, autolysis and oxidative rancidity ste in few hours post mortem (Eyo, 1983). Based on these available information and the preservative potentials in CPH and KPH, this study therefore aimed at smoking fish with CPH, KPH and compare the effect with that of ordinary firewood.

Objective: The aim of this study was to establish and compare the antioxidative, antifungal and preservative effect of cocoa-pod hush, kola-pod husk and firewood in the smoking of fish.

Materials and Methods

The Kiln

The smoking kilns used for smoking the fish samples were the drum Kiln device adapted by Cocoa Research Institutes of Nigeria (CRIN), to ash cocoa-pod husk (CPH) in soap production. These Kilns were similar to the Drum type smoking Kiln described by Eyo (2001) and adopted by Adebowale (2008) but with the smoking rack situated about 10cm below the top end of the drum .It was made of a complete open roof metal (44-gallon size) with square shape aperture at the base and without any barrier between the heat source and the top end. The smoking rack made of wire mesh was used to expose the fresh fishes to heat source .Smoking materials was then introduced through the base opening and ignited to supply heat.

Fish samples: Live *Oreochromis niloticus* used in this experiment (30kg) were purchased from a sea shore in Ibadan, Oyo State .These fishes were then killed and cut open from the ventral side and all their viscera were removed skillfully. They were thoroughly rinsed and salted .The processed fishes were then divided into three equal portions and skillfully spread over three smoking kilns. Hot smoke was then supplied from each kiln. Kiln A contain dried cocoa-pod husk, B –kola-pod husk and C-ordinary firewood. All kilns were allowed to burn for about two hours after which the fish smoked fish samples were removed and packed polythene nylons for analysis.

Chemical Analysis: Analysis of the proximate composition of both fresh and smoked fishes were carried out according to A.O A.C (1980)

Statistical Analysis: Data collected were analyzed by analysis of variance (SAS 1995).The Duncan‘s multiple range test was used to compared difference among means. (Gomez and Gomez, 1985).

Results: All the smoked fish samples exhibited good smoking qualities. The rate of drying was observed to be fastest in kiln with

cocoa-pod husk as smoking material while that of the firewood smoked sample was the slowest. This was evidenced in the values for moisture content which was highest in firewood smoked sample and lowest in CPH smoked sample. Percentage crude protein values of all the three samples were of this order: CPH> KPH> FIREWOOD. Values obtained for biochemical parameters showed that both CPH and KPH were better than ordinary firewood in terms of antioxidative activity. The significant decreased in the values for biochemical parameter, (particularly TMA) in CPH and KPH smoked samples than that of those of initial values in fresh fish sample indicated that no additional production of trimethylamine as a result of trimthylamine-oxide catabolism occurred in those two smoked fish samples (CPH and KPH). Increase in TMA value in firewood smoked sample beyond that of the fresh sample showed that smoke from firewood has a poorer antioxidative capacity when compared with either CPH or KPH. This might account for the quantity and quality of phenolic compound present in these two husk samples.

Microbial load of all the three smoked samples were found to decreased significantly ($P<0.05$) from that of the initial samples. All of the smoking materials reduced the total fungal count, total coliform count and E.coli population. Invariably, phenolic smoke produced form pyrolysis of wood, cocoa-pod husk and kola-pod hush produces anti-fun

The main sources of domestic fish production in Nigeria is by the Artisanal fishermen who dominate the entire Nigerian inland capture fisheries (Ogali, 1994). Available data show that the artisanal fishermen contribute more than 95% of the local fish production and over 66% of the total fish supply to the nation between 1971 and 1980 (Eyo 1992).

Proximate Composition of Tilapia Oreochromis smoked with CPH, KPH and Ordinary firewood.

Moisture	CPH	KPH	OF
	64.43	63.91	67.78
Crude lipid	0.78	0.96	0.84
Ash	4.82	4.48	3.62
Crude Protein	18.31	17.62	16.28
Total Nitrogen (%)	2.93	2.82	2.60
True Nitrogen (%)	2.76	2.61	2.44
Non-Protein N (%)	6.67	0.50	0.36

Biochemical Analysis of Tilapia Oreochromis smoked with CPH,KPH and ordinary firewood

	CPH	KPH	OF
TMA (mg/kg)	9.80	8.79	11.61
PV (mg/kg)	6.3	7.03	7.41
TBA (mg/kg	0.38	0.20	0.50
AV (mg/kg)	0.56	0.50	1.59
FFA (%)	0.28	0.25	0.80

Microbial Load of Oreochromis milotiaus smoked with CPH, KPH and Ordinary firewood

Sample	Total viable count	Total coli form count	E.Coli	Total fungal count
Initial	28.0×10^5	8.0×10^5	2.2×10^5	0.25×10^5
CPH	26.5×10^5	0.2×10^5	0.1×10^5	0.25×10^5
KPH	0.85×10^5	0.4×10^5	-	0.15×10^5
OF	1.65×10^5	-	-	0.15×10^5

Discussion:

Smoking demands great quantities of firewood, and this demand grow as the movement of fresh fish becomes more difficult because of poor access roads, an increase in the amount of fish being landed and the need for disposal to market outlets (Ssali, Reynolds and Ward, 1992). Availability of firewood for smoking fish is becoming scarce even at global level. Worse still where wood is available, it is very expensive to buy. This consequently increase the overall cost of producing smoked fish. As corroborated by G.R Akande and A.A Ajayi( ).Sustainable agriculture world over now gives attention to sourcing for substitutes for most of the agro-based products whose

availability could no longer be guaranteed. Although Cocoa-pod husk has found its way into feed mill sector. Another alternative use of Cocoa- pod husk is its use as alternative to firewood in the smoking of fish (Adebowale *et al*, 2008).The shortage of fuel-wood as well as the increase in the cost of purchase warrants genuine concern to secure the continuous production of smoked fish. Research effort to source for alternative to wood fuel in fish smoking is scanty. Other fuel source which has been alternatively used in smoking fish include among others: Coconut, sugar cane waste, Palm frond (dry).

Appreciable appearance of fish samples from the three fuel sources showed that all the three smoking materials were good source of heat energy. Cocoa-pod husk, however proved best as drying of fish appeared faster with CPH, than in the other two smoking materials.

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Experimental Title: Nutritional quality and microbial assessment of cocoa powder stored at different storage conditions **(**Igbinadolor, R.O.).

Introduction: Cocoa serves as a raw material for production of beverages (e.g. Milo, Bournvita, Vitalo, etc) and chocolate which is taken by consumers due to its high nutritive value, making it a supplement to a balanced diet. Cocoa also serves as raw material for the production of some cosmetics (Are and Gwyne-Jones, 1974).Though all cocoa products might have similar compositions, their methods of production may differ. Environmental conditions of storage of fresh as well as processed products determine to a large extent the type of organisms that will develop. These conditions are temperature of storage, oxygen, humidity and some intrinsic factors as pH, chemical compositions and moisture content. Processed foods contain varying numbers of bacteria, moulds and yeasts (Jay, 1978; Adams and Moss, 1995).

Cocoa has a high food value. In combination with milk, cocoa beverages are ideal for convalescents to give strength and energy. For some time now, cocoa powder has been packaged and sold in small quantities in polythene bags, rubber container etc. due to

this method of production prompted this investigation to evaluate changes in the numbers of microbial groups and nutritional properties in cocoa powder during storage at room and refrigeration conditions and to identify the microbial contaminants of the product.

Materials and Methods

Collection of Samples

The cocoa powder used was obtained from CRIN, Ibadan. It was collected immediately after production and carefully sealed in a polythene bag and transported to the laboratory for analysis.

Enumeration of Microorganisms in Cocoa Powder: The microbiological analysis of the samples was carried out at 7-day intervals for 42 days. The samples were analysed for the presence of coliforms, fungi, and total viable bacterial. One millitre (1ml) of serially diluted suspensions of the cocoa powder was plated on nutrient agar (NA), MacConkay agar and Potato dextrose agar (PDA, Oxoid) for the enumeration of total viable bacterial, coliforms, and fungi respectively. After incubation, the colonies, which formed in each plate, were counted. The microbial isolates were characterized and identified using the Bergeys Manual of determinative Microbiology.

Determination of Physico - Chemical Properties: Other parameters were carried out to ascertain the changes induced by the level of organisms encountered include, pH determination, ash content, moisture content, fat determination and vit. A content respectively.

Results

Table 1: Counts of total viable bacteria and fungi in cocoa powder stored at room and refrigeration conditions.

Period of Storage (days)	Bacterial Counts RC	Bacterial Count (cfu/g) FC	Fungal Counts RC	Fungal count (cfu/g) FC
0	3.6×10^5	3.6×10^5	2.2×10^2	3.7×10^2
7	4.0×10^5	3.9×10^5	3.0×10^2	2.0×10^2
14	5.0×10^5	4.1×10^5	4.2×10^2	2.0×10^2
21	7.5×10^6	5.0×10^4	3.5×10^2	2.0×10^2
28	9.2×10^6	6.0×10^3	3.6×10^2	1.5×10^2
35	3.0×10^7	5.0×10^3	4.0×10^2	2.0×10^2
42	5.0×10^7	6.5×10^3	4.0×10^2	1.8×10^2

RC: room condition; FC: refrigeration condition; cfu/g: colony forming units per gram of sample.

Coliforms were not detected in the samples The bacterial isolates identified were *Staphylococcus aureus, Staphylococcus epidermidis, and Bacillus* . The fungal isolates were identified as *Aspergillus niger, Penicillium* sp., *Aspergilus fumigatus* and *Trichoderma sp*.

Discussion: The results of this study showed that bacteria and fungi survived in cocoa powder stored at room and refrigeration conditions. Under refrigeration condition, there was a decrease in the microbial count, which may be due to their inability to proliferate at low temperature (i.e 5 ± 2^oC) in the refrigerator. The increase in bacterial counts at room conditions showed that bacterial growth was encouraged under that condition.

. Bacteria and fungi isolated in this study were *Bacillus subtilis, Staphylococcus aureus, Staphylococcus epidermidi* respectively. These organisms have been reported in cereal powder and food condition (Frazier and Westhoff, 1988). The presence of *Bacillus* sp. The sample could be due to their ability to form spores which help them to withstand unfavourable conditions.

Table 2: Nutritional characteristics of selected beverages

Sample	Protein (%)	Fats (%)	Ash (%)	Vitamin A (IU)	Vitamin C (mg/100l)	Moisture content (%)	pH
Bournvita	7.25	1.8	2.2	6000	24	3.0	6.07
Milo	12.5	1.6	2.1	4500	22	3.	7.41
Vitalo	7.0	1.8	2.4	4000	20	3.0	6.54
Cocoa Powder*	4.5	1.6	2.1	4000	20	3.4	5.32

*Nutritional qualities of freshly processed cocoa powder used in the present study.

The presence of *Staphylococcus* in the samples may be due to body contact by the handlers during processing because these organisms are present on the human skin. Some strains of *S. aureus* are known for the production of enterotoxins which are involved in food poisoning (Frazier Westhoff, 1988, Adams and Moss, 1995). Some *Aspergillus* species also produces mycotoxins which can be of health implication to man.

Chemical analysis showed that at room condition there was an increased in the pH values while the pH under refrigeration condition rapidly decreased after sometime due to the state of inactivity at low temperature. The general decrease in moisture content of the samples at room condition of storage could be due to the use of moisture by microorganisms for growth while the mutual lack of change in the refrigeration condition may be due to high humidity in the refrigerator. The ash content of the sample decreased from 2.1% to 20.% for both conditions of storage. This may be as a result of depletion in the organic matter of the samples due to activity of microorganisms. At refrigeration condition, the decrease in crude protein of the samples was not as rapid due to reduced microbial activity in the samples brought about by low temperature ($5 \pm 2^{o}C$) of storage.

Comparison between the cocoa powder and other some selected commercial beverages sold in Nigeria showed that the powder had an overall low nutrient content. Cocoa powder had low pH (5.32) and low protein content (4.5%) as compared to the commercial beverages. This shows that, though cocoa powder has acceptable levels of vitamins A and C, it will need to be enriched with milk to increase its protein content. However, cocoa powder can be readily consumed like other beverages.

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LIBRARY DIVISION

2008 REPORTS

Library promotes and disseminates information about the Institute mandate crops. Books and periodicals were acquired in the library in the last fiscal year. Electronic resources were also consulted by the researchers and other library users. The linrary was opened to Scientis and non scientists in the surrounding area who needed a quite environment to study. Visitors from nooks and corner of the country including IT students and Corp members visited the institute library. Some of our scientists were given letter of introductions. Some materials were sent to the substation libraries including all the work emanated from the institute.

It is hoped that more funds will be allocated in the next fiscal year to enable the department continue with the journal subscriptions and also carry out its vision of sourcing and acquiring electronic information to facilitate research and academic productivity. Internet services in the inactivities is very low and the broadland width subscription is underutilized due to epileptic power supply from the National Grid. The alternative power supply could only be provided maximum of 3 hours due to overheld cost.

2008/2009 INTERNAL AUDIT REPORT

Head, Internal Audit (Fabowale, K .M)

Audit of the financial and non-financial activities of the Cocoa Research Institute of Nigeria (CRIN) for the financial year 2009 were done on a continuous basis for the purpose of ensuring compliance with financial and other regulations and reduce the chances of errors and frauds.

HEADQUARTERS:

The records of accounts maintained in various banks by the Institute were checked. All project accounts, imprest accounts, records of stores, records kept at the health centre, records kept at the Institute's rest house, activities and records of sales at the Sales and Marketing Section were all checked for the year under review.

Procurement of items was done in accordance with the procurement procedures and items purchased were physically sighted before they are used.

Salaries and Allowances, Duty Tour Allowances and other personal allowances were paid as appropriate and in accordance with the applicable rates.

Pensioners were paid their retirement dues in the year as appropriate and the B.O.T records were checked.

SUBSTATIONS:

Revenue generated by the six (6) substations (Owena, Uhonmora, Ochaja, Ibeku, Ikom and Mambilla stations) were made quarterly by all the stations. Headquarters' copies of the quarterly returns were checked and physical audit visit carried out to all the stations for the 2009 financial year.

CONCLUSION:

Some observations were made and the attention of the Officer/Department concerned called to the necessary amendments which were done.

In the absence of any material misstatement the financial and non-financial activities of the Institute for the year 2009 was well conducted and complied with all relevant laws.

PLANTATION AND ESTATE MANAGEMENT

INTRODUCTION

There are three major units in the plantation and management section namely:

UNIT I – This consists of seven zones where plantations of CRIN mandate crops with the exception of Tea are situated. The total acreage and crops in each zone are stated in table 1.

UNIT II – Consists of the Ground Maintenances which is involved in the General maintenance of Institute's environment.

Propagation and maintenance of horticultural/ornamental plants, with landscape design.

UNIT III – Fermentary: This section deals with the fermentation and drying of cocoa beans, depulping and drying of coffee berries etc.

PLANTATION ACTIVITIES

The following activities were effectively carried out in the existing plots in all the zones at the headquarters.

Weeding (manually and chemically controlled)

Supply of missing stands

Removal of mistletoes/moribund plants

Pruning of branches, thus reducing the canopies

Watering of young cocoa plants

Rehabilitation of cocoa plants

Cutting of fire traces round the plantations and the ERLS buildings

Preparation of mini cocoa nursery in the zones

Maintenance of the Institute's environment such as the office/laboratory complex, D1 & DD1 quarters, rest house/chalet building, junior and senior staff club, health centre, football pitch, road sides from the main gate to the central nursery, road sides of the S.S and T.O. quarters, water works road via zones 9.

Planting and maintenance of hedges and ornamentals (potted ones inclusive).

Harvesting and processing of viable farm produce for sale and research purposes. A total numbers of cocoa pods, cashew nuts, palm fruits, kola nuts, bunches of banana and bunches of plantain were harvested. Table 2 shows the details.

Drying of cocoa beans and presentation of dried cocoa beans for sales.

RESEARCH ACTIVITIES

The following cultural activities were carried out in the plots bearing research activities; slashing, felling and cross cutting of forest trees, marking out and pegging, holing, weeding, coppicing of coffee trees, fertilizer application, harvesting, filling of poly bag with top soil, cutting of traces and data collection. Towards the end of the year research casual were staffed and some of then were redeployed to Administrative section but we still struggled to assist the Researchers. Some of the abandoned research plots are now receiving attention.

4 REVENUE

Apart from the supply of 56,915 (fifty thousand) cocoa pods to NCDC in some cocoa producing states, a total number of two thousand, one hundred and sixty two pods were sold at the total sum of ₦129,720. A sum of ₦1,095,540 was realized from the dried beans of the above with a weight of 6,503kg. A sum of ₦167,450 was also realized from 6,698 cocoa seedlings, ₦66,850 from 1,237 kola seedlings ₦13,500 from kola nuts, ₦70,800 from 3,832 plantain suckers, ₦14200.00 from 142 bunches of banana, ₦8,000 from star apple, ₦13,075 from wood log ₦825.00 from cashew seedling and ₦4,300 from maize. The zonal leaders that produced maize were commended for their commitment for they purchased the grains from their personal purses.

Revenue from other products: ₦20,700 from 138 portions of palm fruits (2 bunches, 1 portion) ₦4,590 from coffee seedlings, ₦1540.00 from coffee seeds and ₦4,250 from 9kg of cashew nut (table 5).

5 PERSONNEL

The Plantation and Estate Management section worked with a total number of 115 members of permanent and casual staff from January to August and ended up with 119 members in December 2008. Three (3) members of staff retired from the service while seven Agric Cadre Staff joined the roll. There is hope of having most of our casual workers staffed permanently early next year.

6 COMMENDATION

In my last report there was a long list of problems with suggested solutions. I wish to appreciate the Executive Director and members of the IMC for granting the section fund to purchase most of the implements and herbicides needed for the plantation activities. This affected the progress of work in the section positively. The most interesting aspect was the commencement of the renovation of P.E.M main office and some of the zonal buildings. This increased the sense of belonging of all the members of staff before they felt neglected.

I will feel uncomfortable if the efforts of the zonal leaders and the entire members of staff is not appreciated. Everybody worked with great commitment. No wonder we were able to achieve the establishment and maintenance of new 12 hectares of cocoa plots which has been wish of CRIN management years back. We hope to continue in 2009 by God's grace.

7 REQUEST

A child will always ask for more, it will be more appreciated if:

The section can have a vehicle being controlled by itself, this will enable us to minimize the consumption of fuel and control its maintenance.

The porosity of the plantation has increased. The log forester/log fellers did a lot of havoc to our young cocoa plants by passing through illegal roads. Thieves are also having free access to pilfer plantain and some other products. This can be controlled by fencing round the Estate or tentatively provide security van that can patrol the zones and estate as a whole during and after official hours and even weekends/public holidays.

Workers can be encouraged by granting incentives and paying wages early.

Long live CRIN, long live the Executive Director and IMC members.

Table 1

Zone	Total hectrage	Effective hectrage	Crops planted
Zn 1	49.01	34.45	Cocoa, coffee, kola & cashew
Zn 2 – 4	31.20	20	Cocoa, kola & cashew
Zn 5	37.86	17.72	Cocoa, coffee, kola, cashew & citrus
Zn 6	53.087	16.64	Cocoa, cashew & kola
Zn 7	26.48	-	Kola
Zn 8	39.76	28.76	Cocoa, cashew, palm oil
Zn 9	29.35	11.86	Cocoa, oil palm, cashew

Table 2 :HARVESTING RECORD OF COCOA PODS (JANUARY – DECEMBER 2008)

Month	Total number of pods
January	44,786
February	37,755
March	22,339
April	38,185
May	37,969
June	20,776
July	5,230
August	537
September	15,841
October	15,840
November	24,132
December	30,016
Total	293,406

Table 3: COCOA POD SUPPLIED TO COCOA GROWING STATES (NCDC PROGRAMME) DECEMBER 2007 – MARCH

State	No. of cocoa pods collected
Ogun	27,495
Oyo	24,570
Kwara	4,450
Edo	400
Total	56,915

Table 4

Serial No.	Harvesting Date	Total of pods harvested	Field B/Pod	D/Pod	No. issue date	No. of pods fermented	Wet weight	Wt. after fermentation	Dry wt.
1	JANUARY	44,786	1338	2065	20982	16872	1497.4	13235.4	500.4
2	FEBRUARY	37,755	5078	3281	15780	13022	1011.8	827.8	335.8
3	MARCH	22,339	3041	1995	9055	7791	660.8	597.4	229.2
4	APRIL	38,185	4646	2969	4636	23226	1976.4	1822.8	661.4
5	MAY	37,966	3851	3302	20	27069	2344.6	2115.8	784.6
6	JUNE	20,779	2298	2322	460	14029	1225.0	1061.4	410.4
7	JULY	5,230	1037	654	100	3337	287.8	262.2	94.8
8	AUGUST	537	84	49	-	336	26.0	23.0	9.0
9	SEPTEMBER	15,841	3234	1093	-	13131	1251.4	1071.6	416.8
10	OCTOBER	15,840	2856	1539	85	12732	117'1.0	1082.8	392.6
11	NOVEMBER	24,132	3034	1883	11780	7814	613.4	522.3	206.8
12	DECEMBER	30,016	3437	2073	5150	20279	19'19.6	1600.8	642.8
	TOTAL	293,406	36934	23225	68048	159638	13984.8	11822.5	4684.6

Table 5: REVENUE GENERATED FROM FARM PRODUCE IN THE PLANTATION

Farm produce	Quantity	Amount (₦)
Cocoa pods	2162	129,720
Cocoa beans	6503kg	1,095,540
Cocoa seedlings	6698	164,450
Kola seedling	1237	66,850
Plantain suckers	3832	70,800
Plantain	106	31,800
Cashew seedling	9	825
Kola nuts	-	13,500
Maize	860	4,300
Banana	142	14,200
Star apple	4 trees	8,000
Wood (logs) + access fees	-	14,575
Palm fruits	138 (bunches)	20,700
Coffee seedlings	303	4,590
Coffee seeds	6	150
Cashew nuts	9kg	4,250
Total		1,644,250

OWENA SUB-STATION

HEAD OF STATION – (O. S. IBIREMO)

STAFF DISPOSITION: The staff list at the sub-station during the year under review was as stated below.

S/N		OWENA	IDANRE	IBULE	ONISERE	TOTAL
1	Chief Research Officer	1				1
2	Chief Agric Supt	1				1
3	Principal Agric Supt	1				1
4	Chief Typist	1				1
5	Higher Executive Officer	1				1
6	Higher Agric Supt	3				3
7	Chief Clerical Officer	1				1
8	Security	1		1		2
9	Motor/Tractor Driver	1				1
10	Senior Clerical Officer	1				1
11	Health Assistant	1				1
12	Field Overseer	2				2
13	Field Attendant	2		1		3
14	Driver	1				1
	Total	**18**		**2**		**20**

During the year, Mrs. Akinrowo who was a Chief Agric Supt retired from the service and a Principal Agric. Supt (Mr. Ojeyemi T.) was transferred back to Headquarters (Ibadan). Two Higher Agric. Supt were posted to the

station, and a driver and one Health Assistant were also appointed for the station.

OBITUARY: one member of staff Mr. AkintadeOlotu who was the Ibule Watchman/Security passed on in July 2008.

LABOUR: The station has only (5) casual workers at the station i.eOwena main station and the outstations.

SECURITY: The station has only one permanent staff in the station; the other three are casual staff.

REVENUE: A sum of four hundred and ninety nine thousand and eight hundred and ninety naira only (N499, 890.00) was realized from sales of farm produce and other services. The break-down is shown in the table below.

S/N	ITEM	1ST₦ QUARTER	2ND₦ QUARTER	3RD₦ QUARTER	4TH₦ QUARTER	TOTAL₦
1	Cocoa Beans	12,200.00	42,760.00	28,740.00	22,300.00	106,000.00
2	Cocoa Pods	63,000.00	600.00	12,710.00	600.00	20,210.00
3	African star apple (Agbalumo)	500	-	-	-	500.00
4	Cocoa Seedlings	125,000.00	-	-	-	125,000
5	ogbono	800.00	-	-	-	800.00
6	Plantain/ Banana	1,900.00	-	-	-	1,900.00
7	Rent (Pay Roll)	24,000.00	24,000.00	25,500.00	25,200.00	99,000.00
8	Rent (Tenants)	12,000.00	10,500.00	8,000.00	24,250.00	54,750.00
9	Electric (Pall Roll)	8,400.00	7,800.00	9,540.00	9,600.00	35,340.00
10	Electric (Tenants)	10,350.00	11,390.00	6,600.00	3,300.00	31,640.00
11	Rest House	2,000.00	3,500.00	1,000.00	750.00	7,250.00
12	Tractor Services	6,000.00	-	5,000.00	6,500.00	17,500.00
	Total	**266,150**	**100,550.00**	**97,090.00**	**92,800.00**	**499,890.00**

GENERAL MAINTENANCE OF PLANTATIONS: Much could not be achieved in this area as a result of lack enough hands. Though few people were hired from Owena village (daily paid) but it couldn`t help the situation.

ILLEGAL FELLING: However during the year, illegal felling of trees was done by unknown people at the station, in which the case was reported to the Executive Director and the Ondo State Ministry of Agric, Fisheries and forestry.

RESEARCH ACTIVITIES: Demonstration plot was established with experimental trial on:

Exp I: Influence of root mat removal and SSP fertilizers on the establishment of cocoa seedlings in the field.

Exp II: Influence of root mat removal and N P K fertilizers on the establishment of cocoa seedlings in the field.
Data collection commenced a month later and has since been done on a monthly basis. The experimental plots were also taken care of although unavailability of labour affected the plots as regular weeding operation could not be carried out as at when due.

Cocoa seed Garden Plot: Cocoa seedlings were planted on seed garden plot. Regular watering was carried out because the seedlings were planted late.

NURSERY: Cocoa seedlings were raised during the year, large quantity of the seedlings were booked by the STAMARK Ondo.

WEATHER RECORDS: This was not taken because the equipments were bad.

INFRASTRUCTUREAL DEVELOPMENT: Renovation works were carried out in H O S quarters TO 1 and TO 2. The office complex also was given a face lift through repairs of leaking roofs and replacement of ceiling boards. It was also painted and some of bad doors and netting were removed and replaced. The Cameroon artificial dryer was removed and replaced with a drying shed. The floor of the car park was concreted.

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