



COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH  
**FOOD RESEARCH INSTITUTE**

# Annual Report 2011





COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

**FOOD RESEARCH INSTITUTE**

**ANNUAL REPORT 2011**



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## LIST OF ACRONYMS

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AFTER	-	African Food Tradition Revisited by Research
AGORA	-	Access to Global On-line Research on Agriculture
AGRIS	-	Agriculture Research Information System
BFGs	-	Business Focus Groups
C:AVA	-	Cassava: Adding Value in Africa
CAFPAG	-	Cassava Flour Producers Association of Ghana
CID	-	Commercialization & Information Division
CPC	-	Cocoa Processing Company
CRI	-	Crops Research Institute
CSIR	-	Council of Scientific and Industrial Research
CSU	-	Clients Service Unit
CTA/SDI	-	Technical Centre for Agriculture and Rural Cooperation/ Selective Dissemination
EU	-	Engineering Unit
FAO	-	Food and Agriculture Organization
FAPAS	-	Food Analysis Performance Assessment Scheme
FCD	-	Food Chemistry Division
FDB	-	Food and Drugs Board
FMD	-	Food Microbiology Division
FNSED	-	Food Nutrition and Socio-Economics Division
FPED	-	Food Processing & Engineering Division
FRI	-	Food Research Institute
GIMPA	-	Ghana Institute of Management and Public Administration
GIZ	-	German International Cooperation
GoG	-	Government of Ghana
GPCs	-	Good Practice Centres



HQCF	-	High Quality Cassava Flour
IGF	-	Internally Generated Funds
INSTI	-	Institute for Science and Technological Information
IPS	-	Institute of Professional Studies
KNUST	-	Kwame Nkrumah University of Science and Technology
LPPRU	-	Library, Publications and Public Relations Unit
MiDA	-	Millennium Development Authority
MOAP	-	Market-Oriented Agriculture Project
MoFA	-	Ministry of Food and Agriculture
MU	-	Mushroom Unit
PSPU	-	Pilot Scale Production Unit
RTPDU	-	Root and Tuber Products Development Unit
SANAS	-	South African National Accreditation System
SMEs	-	Small and Medium Scale Enterprises
SRI	-	Soil Research Institute
STEPRI	-	Science and Technology Policy Research Institute
TBSU	-	Technological Business Service Unit
TEEAL	-	The Essential Electronic Agricultural Library
UNICEF	-	United Nations International Children's Education Fund
WFP	-	World Food Programme
WAAPP	-	West African Agricultural Productivity Programme

## CSIR-FRI MANAGEMENT BOARD MEMBERS

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1.	Dr. Osei Boeh-Ocansey	Director-General, PEF	Chairman
2.	Dr. P-N.T. Johnson	Acting Director, FRI	Member
3.	Dr. E.B. Hagan	Director, IIR (Cognate)	“
4.	Dr. (Mrs.) R. Entsua-Mensah	Deputy Director-General CSIR	“
5.	Mr. Timothy A. Osei	Chartered Accountant	“
6.	Prof. Josephine Nketsia-Tabiri	Director, BNARI, GAEC	“
7.	Mr. Charles Debrah Asante	Deputy Managing Director, CPC	“

## MEMBERS OF CSIR-FRI INTERNAL MANAGEMENT COMMITTEE

1.	Dr. P-N.T Johnson	-	Ag. Director	-	Chairman
2.	Dr. Kafui Kpodo	-	Deputy Director/Head/FCD	-	Member
3.	Dr. Nanam Dziedzoave	-	Head/FPED	-	“
4.	Mrs. Margaret Ottah Atikpo	-	Head/FMD	-	“
5.	Mrs. Wilhelmina Quaye	-	Head/FNSEED	-	“
6.	Dr. Kwame Vowotor	-	Head/CID	-	“
7.	Dr. Lawrence Abbey	-	Quality Manager	-	“
8.	Dr. (Mrs.) Mary Obodai	-	Head/Mushroom Unit	-	“
9.	Mr. Cletus Gyato	-	Head/Eng. Unit	-	“
10.	Mrs. Mary Glover-Amengor	-	Head/Nutrition Unit	-	“
11.	Mr. Joseph Gayin	-	Ag. Head/PSPU	-	“
12.	Mr. Elvis Baidoo	-	Ag. Head/RTPDU	-	“
13.	Ms. Janet Aggrey-Yawson	-	Ag. Head/Admin	-	Secretary
14.	Mr. C. A Tutu	-	Ag. Head/ Accounts	-	Member
15.	Mr. Peter Addo	-	President, RSA	-	“
16.	Mr. David Asiedu	-	Chairman, Staff Welfare	-	“
17.	Mr. Ben Awotwi	-	Chairman, SSA	-	“
18.	Mr. Michael Amoo-Gyasi	-	Chairman, TUC	-	“
19.	Mr. Stephen Nketia	-	Scientific Secretary	-	“
20.	Mr. Eric Ofori	-	Prin. Admin. Asst.	-	Recorder



## EXECUTIVE SUMMARY

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Food Research Institute (FRI), one of the Institutes of the Council for Scientific and Industrial Research (CSIR) is mandated to generate technologies that are intended to meet the demands of the private sector and other stakeholders for the socio-economic development of the country. Its vision is to be the leading research institute in the area of food processing technology. It is tasked to provide technical, analytical services, contract research and consultancy services to governmental agencies, micro-medium and multinational agro-food processing industries and international development agencies. It has persistently positioned itself to primarily conduct market-oriented applied research and provide technical services and products' market viability to the private sector and other stakeholders. The goal of the Institute over the years is to assist in poverty alleviation through the creation of opportunities for generating and increasing incomes within the micro, small, medium and large-scale agro-food industries; contribute to food security, foreign exchange earnings and the application of cost-effective food processing technologies that are environmentally friendly.

CSIR-FRI continued with its development of cassava, plantain, cocoyam, yam, kokonte, cowpea, and soybean, fermented flours, among others to ensure food Security and reduce post-harvest losses. The Institute also continued providing services including the design and fabrication of food processing equipment, analytical services, training programmes such as; product development (nutrition, sensory analysis, recipe development and shelf-life studies), as well as mushroom cultivation and spawn production, microbiological and chemical safety and quality control of foods; consultation and out-sourcing services, such as the establishment of Hazard Analysis and Critical Control Point (HACCP) system for food industries, post-harvest management, etc.

The Institute maintained its accreditation status to ISO 17025 test methods under the South African National Accreditation System (SANAS). In accordance with accreditation activities, comprehensive chemical and microbiological analytical services were offered to the local beverage, food, feed and brewing industries. As per ISO/IEC 17025 standards, two internal audits were conducted in the laboratories and other units that support the implementation of ISO/IEC 17025 standards by the laboratories.

During the year under review Forty-Seven (47) Scientific Reports and Publications were produced. These include Sixteen (16) Research Reports, Twenty (20) Journal Papers published in thirteen (13) refereed journals, Five (5) Conference Papers and Posters etc. The research activities conducted include; Research on Biodiversity, Ecology and Uses of larger fungi (Macromycetes, Basidiomycota, Fungi) in West Africa, Evaluation of

disinfectant for microbial decontamination of the microbiology laboratory floor by an in-use test, Standardization of pineapple flour and syrup for the confectionary industries CSIR-FRI /TNO Project, Accra, Ghana. pp. 27, Technical assessment of Rice production and Post-harvest practices: baseline and needs assessment in Upper West Region, Relationship of sensory and instrumental aroma measurements of dark chocolate as influenced by fermentation method, roasting and conching conditions, among several other Research Reports.

In the Area of Project Implementation, The Cassava: Adding Value in Africa (C:AVA) project which was expected to end in March 2011 was given a two (2) year low cost extension, thus it is estimated to end in the year 2013. The new directive still focuses on improving cassava value chains but is narrowed down to processing, market development and credit management excluding production activities. A 30-minute documentary titled 'High Quality Cassava Flour-The Hidden Treasure in Cassava' was produced as part of an intensive mass media campaign. Gradually, the concept of using HQCF/Grits as poultry and pig feed substitute is gaining ground as farmers are beginning to understand the concept.

Significant gains have also been achieved under The West African Agricultural Productivity Project (WAAPP). There has been an increased production of major Roots and Tubers; 86% for cassava, 35% for yam and marginal increase for sweet potato and cocoyam. A West Africa Root and Tuber Crops Conference was held focusing on how to increase contribution of the WAAPP to national development by spearheading the purposeful implementation of conference recommendations, contribute to the achievement of the MDGs-the eradication of extreme poverty- in root and tuber producing communities as well as increasing the contribution of root and tubers to the National Agricultural GDP.

Substantial progress were also made under the other projects including African Food Tradition Revisited by Research (AFTER) Project, CIDA-funded/AfricaRice Project on Rice post-harvest handling, marketing and the development of new rice-based products. The most important partners of the different projects being implemented by the Institute included the United Nations-Food and Agricultural Organization (UN-FAO), the Ministry of Food and Agriculture (MoFA), The Natural Resources Institute (NRI) of University of Greenwich, UK, The World Bank, Kwame Nkrumah University of Science and Technology (KNUST), University of Ghana, as well as other Agriculture and Industry related CSIR Institutes.

As part of the Institute's income generation effort, the Institute generated a total income of GH¢474,659 which represented 13% increase over that of 2010.

## 1.0 ADMINISTRATION DIVISION

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### Introduction

The Administration Division provides administrative support for the research and technological programmes as well as for the efficient running of the Institute. The Division also assists with the day-to-day operational functions of the Institute. During the year, the Division continued with one of its core mandates of offering training opportunities to staff to enable them acquire skills and expertise required to improve their performance.

### Staff Strength

The staff strength of the Institute increased from 174 to 186 with the recruitment of twelve (12) additional staff (Table 1.1).

Table 1.1 Staff Strength

Category of staff	Number
Senior Members	45
Senior Staff	72
Junior Staff	69
<b>Total</b>	<b>186</b>

### Staff Movement/Appointments

Dr. (Mrs.) Kafui Akuwa Kpodo, Principal research Scientist was appointed Deputy Director of the Institute with effect from 1st February 2011. Dr Margaret Owusu transferred to the Food Chemistry Division after completion of her PhD studies. Mr. Ebenezer Tawiah was recruited and started work with the Division in January 2011 as a Technician. Twelve (12) staff were given temporary appointments. The new appointees consisted of One (1) Senior Member, seven (7) Senior Staff and Four (4) junior staff as shown in Appendix III.

### Headship of Units

Mr. Charles Diako and Mr. George Anyebuno, Research Scientists, were appointed Heads of Industrial Services Unit and Mycotoxins Units of the Food Chemistry Division, respectively.



Mrs. Ivy Yawson, Research Scientist was also appointed Head of the Industrial Services Unit of the Food Microbiology Division. These appointments took effect from 1st April, 2011. Mr. Cletus Gyato was appointed Head of the Engineering Unit with effect from 1st September 2011.

### **Human Resource Development/Training**

The Institute continued to grant training opportunities to staff to enable them acquire skills and expertise needed to enhance their performance.

### **Sabbatical leave**

Dr. John T. Manful, a Principal Research Scientist and Head of PSPU was granted a two-year sabbatical leave with effect from 1st September, 2011. He is expected to be back at post on 1st September, 2013.

### **Leave without pay**

A one-year leave without pay was approved for Mr. Foster Yao Mensah, an Assistant Research Scientist with the Food Chemistry Division (FCD) on application. The leave commenced on 28th July, 2011.

### **Resignation**

Mr. Moro Adams and Daniel Adjah Anang, both Research Scientist with the FPED employed in October 2010 resigned their positions in April and September 2011 respectively. Mr. Seth Obiri Yeboah, who was offered a temporary appointment in July 2011 as a Technical Officer with the Food Microbiology Division (FMD) resigned from the Institute effective December 2011.

### **Attachment Training**

The Institute continued to provide opportunities to students from tertiary institutions to undertake their internship programmes in the various Divisions especially Food Chemistry Division (FCD), Food Microbiology Division (FMD) and Food Processing and Engineering Division (FPED).

### **National service postings**

The Institute has received postings of two (2) personnel for the 2011/2012 National Service year. They are Ms. Gloria Adjei who is with the FPED and Mr. Otobil Shadrack with the Food Nutrition and Socio-economic Division (FNSED). Meanwhile, Mr. Alexander Henry Appiah, Ms. Kukua Ama Thompson and Ms. Judith Narkie Larweh, 2010/2011 National

Service Personnel were given a one-year extension of their National Service at the Institute. The effective date for the extension was 1st September, 2011.

### **Sick leave**

Mrs. Ivy Yawson, a Research Scientist and Head of Industrial Services Unit (ISU) of Food Microbiology Division has been granted a six-month sick leave with effect from 1st July, 2011. Mr. Ransford Addo, a Principal Technical Officer and Mr. Michael Mensah, Security Assistant Gd. 1 are also on sick leave.

### **Retirement**

The under listed staff of the Institute have proceeded on compulsory retirement after rendering several years of meritorious service to the Institute.

- Dr. Wisdom Kofi Amoa-Awua, Chief Research Scientist and Former Head of the Food Microbiology Division retired on 28th February, 2011 after 35 years of service.
- Mr. Daniel Blay, Senior Research Officer and Former Head of the Engineering Unit, after 23 years of service.
- Mr. John Freeman Asigbey, Chief Admin. Assistant of Administration Division after 33 years of service.
- Mr. William Aमेvor, Chief Technologist of FCD after 31 years of service.
- Mr. John Asarfu-Agyei, Chief Technical Officer of FPED after 35 years of service.
- Mrs. Iris Tamakloe, Chief Technical Officer after 26 years of service.

### **Post retirement contract**

Dr. Wisdom Amoa-Awua was offered a two-year post retirement contract as Chief Research Scientist with the Institute effective from 1st May, 2011.

### **Other activities**

- The Africa Rice Project was launched on 16th August, 2011 at Mensvic Hotel, East Legon.

## 2.0 ACCOUNTS DIVISION

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### **Introduction**

The Finance and Accounts Division is responsible for maintaining effective and efficient accounting and financial systems. The Division ensures that, the Institute is in compliance with the CSIR stores and financial regulations and other statutory legislations. The Division supports all the other Divisions to carry out their financial obligations for the smooth running of the Institute. It prepares financial statements, annual budgets, and administers funds from donors. There are two main sections of the Division: the main finance and accounts and the Stores sections. The main finance section is made up of the ledger, the payroll, final accounts and the cash sections. The Stores section undertakes procurement duties, receives and issues items procured for effective running of the Institute. These items include chemicals, media, stationery, etc.

### **Major Activities**

The major activities of the Division include;

- Preparation of Financial Statements for the Institute,
- Preparation of financial report on Government of Ghana (GoG) funds and disbursements
- Ensures that funds from donors comply with programmed budgets
- Ensures compliance with Taxation and other financial reporting regulations
- Manages the payroll function to ensure efficient processing systems and better control mechanisms
- Oversees both internal and external auditing of our books, review and analyze reports and give recommendations when appropriate.
- Preparation of monthly and quarterly financial reports to CSIR Secretariat and other statutory bodies.

### **Main activities within the period under review**

The following activities were accomplished in 2011:

- The 2010 final accounts was audited and signed within the first half of the year.
- All statutory reports to the ministries, CSIR and other state agencies were made.
- Entries for the 2011 accounts have been made to November, 2011.



Table 2.1 Financial Overview of 2011

Items	FRI Budgeted Income GH¢	Actual Income GH¢	Actual Expenses GH¢	Difference GH¢
Personnel Emoluments	2,818,576	2,751,660	2,763,394	(56)
Admin. Expenses	1,630,200	564,319	708,201	(143,882)
Service Activities	349,100	-	-	-
Investment Activities	135,500	-	24,002	(24,002)
IGF ( income)	-	474,919	177,056	297,863
<b>TOTAL</b>	<b>4,933,371</b>	<b>3,802,688</b>	<b>3,648,651</b>	<b>(154,037)</b>

The total income for the year amounted to GH¢3,802,688 of which 87% represents government subvention for personnel emolument and administrative expenses.

#### **CSIR-FRI Internally Generated Income (IGF)**

The Internally Generated Fund (IGF) yielded a total income of GH¢474,919 for the period under review representing 13% of our total income for the year. The total expenses on IGF was GH¢177,056 giving a gross income of GH¢297,863.

### 3.0 COMMERCIALISATION AND INFORMATION DIVISION

#### Introduction

The Commercialisation and Information Division (CID) coordinates the commercial activities of all the other Divisions in the Institute in order to enhance the income generation capacity of the Institute. The Division now has 3 Sections namely the Client Services Section (CSS), Technological Business Service Section (TBSS) and the Information Management Section (IMS). The Technological Business Service Section (TBSS) was established in 2011.

#### Client Service Section (CSS)

The Client Service Section (CSS) is the interface between the Institute and its clients for services in Chemistry, Microbiology, Mycotoxin and Processing. Within the year, the Microbiology, Mycotoxin and Chemistry labs received a total of 2,756 samples from 358 clients which accrued an actual income of GH¢311,085.95 as at 31st December 2011. The details are shown in Table 3.1.

Table 3.1 Details of actual income generated from clients for the Client Service Section (CSS)

Lab.	No. of Clients	No. of Samples	Actual Income (GH¢)
Microbiology	158	1951	236,123.30
Chemistry	156	543	44,463.60
Mycotoxin	44	262	30,463.60
<b>Total</b>	<b>358</b>	<b>2,756</b>	<b>311,085.90</b>

Out of 358 clients, 60 (16.80%) of them were new. Some of the major clients were the Cadbury Gh. Ltd., Pioneer Food Cannery Ltd, Ghana Standard Authority, Promasidor Ghana Ltd. etc. The Processing & Engineering Lab received a total of 49 samples from 9 clients and generated an income of GH¢2,427.00.

Income generated by the other Cost Centers is shown in Table 3.2.

Table 3.2 Actual income generated by the different Cost Centers

Cost Centre	Actual Income (GH¢)
Sale of products	37,671.00
Processing and Engineering Lab.	200.00
Training	14,269.00
Miscellaneous	23,717.45
<b>Total</b>	<b>75,858.15</b>

### Marketing Plan

Two marketing planning sessions were held at Bonsu and Kade respectively to review the 2011 marketing plan and 2012 marketing plan projection.

### Technological Business Service Section (TBSS)

Within the year, 94 requests were received and 41 of the requests were executed. This formed 43.62% of total requests received. A total amount of GH¢12,132.20 was realized from requests executed as against an expected income of GH¢42,842.81 had all requests been executed. Income realized was thus 28.32% of expected income. The breakdown is shown in Table 3.3

Table 3.3 Income realized from requests executed by the various Divisions

Division	Unit	REQUESTS						INCOME (GHS)
		RECEIVED			EXECUTED			
		Info	Training	Total	Info	Training	Total	
Food Microbiology	MU	1	7	8	1	7	8	1,667.00
	ISU	0	2	2	0	0	0	15.00
Food Chemistry	MU	1	0	1	1	0	1	5.00
	ISU	1	4	5	1	4	5	509.60
Food Processing And Engineering	EU	2	2	4	2	0	2	25.00
	PSPU	4	51	55	4	16	20	7,531.60
	RTPDU	0	10	10	0	1	1	1,758.50
Food Nutrition And Socio-Economics	NU	1	6	7	1	2	3	620.50
	SEU	0	0	0	0	0	0	0.00
<b>TOTALS</b>		<b>11</b>	<b>83</b>	<b>94</b>	<b>11</b>	<b>30</b>	<b>41</b>	<b>12,132.20</b>

The following activities were carried out during the quarter:

- Customer feedback survey
- Updating of clients' database
- Building customer relationship management
- Increasing clientele base for the Institute
- Conducting marketing research appraisal of products
- Sale of Research by-products
- Interfacing with clients for specific needs

### **Increasing Clientele Base of the Institute**

Increasing the clientele base of the Institute is one of the options of increasing revenue. For this reason, the Section undertook prospecting for clients in order to increase the clientele base of the Institute.

### **Appraisal of Products**

The Institute has been putting on the market two main products namely: research by-products and services. From time to time, the Section finds it expedient to appraise these products to find how they are behaving on the market and to help management channel resources to specific product areas. Appraisal is on-going with data collected and analyzed especially for the tangible products.

### **Information Management Section**

The library is one of the most important libraries that provides and disseminates information in the field of food science and technology, nutrition, food microbiology, aflatoxins and mycotoxins, agricultural economics and food engineering in the country. It has a total book stock of over four thousand books (4000) and over 200 back issues of food science and technology journals.

The library has access to numerous electronic databases and journals such as AGORA, OARE, SCIEDIRECT, HINARI, EMERALD, TEEAL, etc. The library also has an in house database known as AGRIS that contains about 300 records. There are over eight hundred (800) soft copies of food science and technology books which are available to research scientists on a shared file on the Institute's Local Area Network.

The clientele of the library has extended beyond the Institute's research scientists and technical staff to include students, lecturers, farmers, industrialists, journalists, civil and public servants, and consultants from the various polytechnics and universities in the country. The library continued to enjoy the availability of internet connectivity making it



possible for the Institute's research scientists and technical staff to browse and access their electronic mails and access full text articles and other relevant information for their work.

### ***Information Request***

Information sought for included publications on various food crop processing, microorganisms in food, functional properties and uses of hydrocolloids in the food industry, physio-chemical properties of food, plant sanitation, fish consumption patterns in Ghana, moisture and ash content of locally produced crops in Ghana, waste management in chemical laboratory, HACCP, rabbit rearing, snail farming, mushroom cultivation, postharvest technology, grasscutter rearing, food quality and nutrition and cancer research were provided for the library users.

### **Public Relations**

#### ***Annual Report for 2010***

The Public Relations formed a Team that prepared the Annual Report for 2010. The members were: Dr. K. A. Vowotor (Chairman), Dr. C. Tortoe, Mr. Steven Nketia, Ms. Mariam Yakubu and Mr. A. Andoh.

#### ***Newspaper Articles***

Several newspaper articles were authored and published in the major newspapers. These include: *Climate change, Iodation of salt: How serious is Ghana, Accreditation for better quality products, Some trees prove destructive with age, and Root and tuber Crops for Industrial Development of West Africa.*

#### ***Exhibitions***

Exhibition materials: photographic, video, brochures, posters and fliers were prepared during the year. A new brochure for analytical services and a new flier for commercial services were prepared and printed during the year.

CID took part in the following exhibitions:

- i. Second Ghana Policy Fair at the Accra International Conference Centre on 26-30th April 2011
- ii. The Day of Scientific Renaissance of Africa that took place at the Graduate School and Allied Sciences (SNAS) of the Ghana Atomic Energy Commission (GAEC) on 28th June 2011.
- iii. West African Agricultural Productivity Fair at the Mensvic Hotel 12-16 October 2011.
- iv. Agricultural Trade and Investment Fair (AGRIFA) at the Trade Fair Site, La, Accra on 14-22 October 2011.

## 4.0 FOOD PROCESSING AND ENGINEERING DIVISION

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### Introduction

The Food Processing and Engineering Division is one of the four technical Divisions of the CSIR-Food Research Institute. The Division comprises three operational units namely, the Engineering Unit (EU), the Pilot Scale Production Unit (PSPU) both of which are located at the Okponglo campus of the Institute, near the Tetteh Quarshie interchange; and the Root



and Tuber Products Development Unit (RTPDU) located at Pokuase in the Ga West District of Accra. The Division has staff strength of 44 and is managed by Dr. Nanam Tay Dziedzoave, the Divisional Head and, assisted by the three unit heads: Mr. Joseph Gayin for PSPU, Mr. Cletus Gyato for the EU and Mrs. Charlotte Oduro Yeboah. Mrs. Charlotte Oduro however was granted study leave during the course of the year and the management of the RTPDU was transferred to Mr. Elvis Baidoo from the 1st of September 2011. The Division has also created five Performance Improvement Teams led by the other senior members in the Division, and whose functions

are to support the Divisional Head in managing cross-cutting functional areas of the Division. The teams are: the Research and Development Management Team, Quality Management Team, the Information Management Team, the Market Development Team, and the Installations and Infrastructure Management Team.

### Major Activities

#### Activities Undertaken by the Pilot Scale Production Unit (PSPU)

- Research and Development activities.
- Consultancy services in Food Product development.
- The provision of technical and analytical services to entrepreneurs.
- Technical Training on technologies developed by the Division.
- The production and sale of Research By-Products.

#### Activities Undertaken by the Engineering Unit (EU)

- Research and Development activities.
- Repair and maintenance of Institute Equipment and Electrical installations.

- Training on the fabrication of Food Processing Equipment developed by the Division.
- Design, fabrication and sale of Food Processing equipment.

#### Activities Undertaken by the Root and Tuber Products Development Unit (RTPDU)

- Research and Development activities.
- The provision of technical services to entrepreneurs.
- Technical Training on technologies developed by the Division.
- The production and sale of Research By-Products.

#### Production and Sale of Research By-Products

Table 4.1 shows the quantities of products processed by the Division during the year. The Division thus processed 20 tons of raw materials into 4.6 tons of finished products.

Table 4.1 Production of Research By-Products in the FPED

	Quantity of Raw Material (kg/no.)	Quantity of Final Product (kg/no)
<i>Agbelima</i>	1,000.00	200
<i>Banku Mix</i>	300.00	200.00
<i>Cocoyam Fufu</i>	1,292.00	347.5
Fermented Maize Meal	300.00	200.00
Groundut Paste	1,041.00	864.98
<i>Kokonte</i>	6,371.00	1,486.03
Plantain Fufu	2,652.00	456.00
Cassava starch	6,546.80	681.20
Yam Fufu	551.00	152.5
<b>TOTAL</b>	<b>20,053.80</b>	<b>4,588.21</b>



### Technical and Analytical Services

Table 4.2 outlines the different types of technical and analytical services undertaken during the year. These included:

- Welding works on: car hinges of the Institute's vehicles, the main gate and the electric generator.
- Repair works on a fume chamber and an oven in the analytical laboratories of the chemistry division.
- Replacement of lamp parts on several of the institute lights. This constituted the bulk of services provided by the Engineering Unit.
- Drying, milling and roasting of a total of over 52 tons of products for clients. The breakdown is indicated in the table. The products involved included, hausa koko, onions, sliced cassava, corn dough, pepper, ginger, soybean, yam bean, groundnuts, potato slices and cowpeas.
- Laboratory analysis of 764 samples for clients. The analysis included drained weight, net weight, solid to liquid ratio, % solids, pH, colour determinations, pasting characteristics, physical quality assessment of grains, and other physico-chemical properties of various food items, some of which are maize, groundnut soup, yam, brukutu drink, tomato paste, corn grits, Ga kenkey, pepper, paddy rice, sweet potato, mango, rock cakes, sweet pepper, flour samples, roasted groundnut, cream of palm paste, garden eggs in brine, parboiled rice, fruit juices, radiated pork etc.
- Shelf life studies on about 43 product samples including pepper and pork.

**Table 4.2: Provision of Technical Services By the FPED during the Third quarter of 2011**

Type of Service*	VOLUME OF SERVICE
	Drying (Kg.)
Milling(Kg)	<b>2,657.00</b>
Roasting (Kg)	<b>3,462.00</b>
Physico-Chemical Characteristics (Number)	<b>764.00</b>
Product Development (number)	<b>3.00</b>
Shelf life studies (Number)	<b>43</b>
Maintenance and Repairs (Number)	<b>158.00</b>
Training (Number)	<b>11</b>

\* Words in parenthesis refer to the unit volume of service for each service type



### **Training Workshops**

A total of eleven (11) clients were trained in the production of:

- Tiger nut juice drink,
- Honey shake drink,
- Flavoured drinks.

## 5.0 FOOD CHEMISTRY DIVISION

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### Introduction

The major function of the Food Chemistry Division (FCD) is to give support to the commercialization activities of the Institute by offering analytical services to Industry, local and International students, as well as training for students. In addition, the Division conducts applied research relating to chemical contaminants such as mycotoxins and trace metals in foods and feeds as well as food flavour (aroma) analyses. The Division also offers consultancy services and advice to clients. The Division comprises two Units namely the Food Toxicology Unit and the Industrial Services Unit.

### Analytical Services

During the year, the Division offered analytical services to several companies, establishments and individuals. A total of 542 samples were received by the Industrial Services Unit for analysis. This number represents a 21.2% decrease over the 688 samples received in 2010.

The samples analyzed included iodated salt, beans, dried mango, gari, tomato paste, cashew nuts, fruit drinks, Sweet potato flour, cereals and cereal products, fish meal, pepper and pepper sauce, sesame seeds, peanut and peanut products, chocolate drinks, beer, fish meal, water, anchovies, Mangoes, dry gin, vegetable oil, sheanuts, corn soya blend, honey, Annato seeds, cocoa butter, ginger, palm-oil, orange lollies, biscuits and cowpea flour among others.

The clients included: Ghana Standards Authority, Intertek Ghana Ltd., Plots Enterprise Ghana Ltd., Guinness Ghana Breweries Ltd., Afrotropic Cocoa Processing, Niche Cocoa Industry Ltd., Promasidor Ghana Ltd., C&S Foods Ghana Ltd., Agricare Ltd., Sterling Foods & Investment, Accra Poultry Farmers Association, Tropical Freshfoods Company Ltd., Elsa Foods Ltd., Ranaan Fish Feed West Africa Ltd., Relief International, Nutriline, Nansel Ventures, Nsawam Cannery, Ghana China Foods Company Ltd., Ghana Inspections Ltd among others. Analysis of the 542 samples generated a gross income of fifty thousand, eight hundred and thirteen Ghana Cedis (GHC50,813) as against a gross income of fifty seven thousand, seven hundred and thirty four Ghana cedis (GH¢57,734.00) for 2010. This represents a decrease of 12% over the 2010 gross income.

During the year, the Toxicology Unit received a total of 262 samples for aflatoxin analysis as against 246 samples for the year 2010. This represents an increase of 6.5% over the previous year. The samples analyzed consisted of fish feed, koko drink, tilapia fish, roasted

peanuts, Tombrown, soybean flour and meal, cashew nuts, peanut butter, rice, maize and maize meal, maize grits, banku mix, wheat and wheat products, spaghetti, cereal mixes, instant soy beverages, rice, cocoa beans, cocoa cake, cocoa liquor, mashed kenkey, beans, dried pineapple and mango, popcorn, corn soya blend, kokonte, chillie and black pepper, Hausa koko and suya powder among others.

The clients included: Ranaan Fish Feed West Africa, Ghana Standards Authority, Jap Environmental Solutions and Quality Consult, C&S Foods Ghana Ltd., Nutriline, Intertek Ghana Ltd., Agricare Ltd., Premium Foods Ltd., Sterling Foods & Investments, Ghana Protein Ltd., SPB Agro Processing Co. Ltd., UNHCR, Bride Tidings Ent. Ltd., St. Baasa Ghana Ltd., Chemico Ltd., Nourisher Processing Company Ltd., Rovers Agro Services Ltd. among others. Total charges for the 262 samples amounted to thirty five thousand, six hundred and sixty six Ghana Cedis (GH¢35,666) as against thirty two thousand, one hundred and fifteen Ghana Cedis (GH¢32,115). This figure represents an increase of 11% over the 2010 gross income.

The gross total for the two Units of the Chemistry Division was therefore eighty six thousand, four hundred and seventy nine Ghana cedi (GH¢86,479). This amount represents a decrease of GH¢3,370 (3.8%) over the gross income for 2010 (Table 5.1)

**Table 5.1 Summary of gross income generated in 2011 by Chemistry Division**

Quarter	Industrial Services Unit		Toxicology Unit	
	No of Samples analyzed	Gross Income GH¢	No of Samples analyzed	Gross Income GH¢
1 <sup>st</sup>	154	13,157	51	6,270
2 <sup>nd</sup>	156	13,936	41	4,800
3 <sup>rd</sup>	140	17,391	83	12,610
4 <sup>th</sup>	92	6,329	87	11,986
<b>TOTAL</b>	<b>542</b>	<b>50,813</b>	<b>262</b>	<b>35,666</b>

## 6.0 FOOD MICROBIOLOGY DIVISION

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### Introduction

The Food Microbiology Division (FMD) has the main task of undertaking research and development activities in food safety and quality assurance for the food industries in Ghana. The Division is made up of two Units, namely the Industrial Services Unit (ISU) and the Mushroom Unit (MU).

The Industrial Services Unit (ISU) carries out services for clients through analyses of samples submitted to the laboratory or sampled directly by staff. The Unit also advises clients and inspects food production premises of clients who include exporters of food products. The analyses carried out are thirteen accredited methods by South African National Accreditation System (SANAS). ISU is also involved in training entrepreneurs and students from tertiary institutions such as Polytechnics and Universities.

The Mushroom Unit (MU) carries out research activities in indigenous and exotic edible and medicinal mushrooms. It disseminates results to stakeholders through training programmes, technical reports and scientific papers. The MU also maintains a National Mycelium Bank which contains samples of mushrooms researched into. The Unit is also engaged in production and sale of mushroom spawns and compost bags to local farmers and researchers in some countries in sub-Saharan Africa like Cote d'Ivoire, Benin and Togo.

### Major Activities and Outputs

#### Activities and Output of Industrial Services Unit (ISU)

The main activities carried out are:

- Technical and analytical services to clients for income generation.
- Quality control of analytical methods under the ISO 17025 accreditation.
- Visit to laboratories of food industries to advise on quality control procedures
- Advice to clients.
- Training of students from tertiary institutions in Ghana.
- Research activities

The ISU continued with routine technical and analytical services carried out for clients who submit samples to the laboratory through the CID. A total of 1,728 samples were analyzed for clients in 2011 as against 1,405 samples in 2010 (Fig. 1.1). This was an improvement of 23 % over samples analyzed in 2010. The total number of individual analysis carried out in



2011 was 6,547 as against 7,311 individual analysis carried out in 2010 (Fig 6.1) Clients that patronized the services of the Division during 2011 included Cadbury Ghana Ltd., Pioneer Food Cannery and Movenpick Ambassador Hotel, Airways Catering Ltd., Burger Food Industries, Cocoa Processing Co. Ltd., Euro Food Gh. Ltd., West Africa Mills Ltd., Ghana Inspection Ltd., Promasidor Ghana Ltd among others.

Fig 6.1 Number of samples analyzed for clients in 2010 and 2011

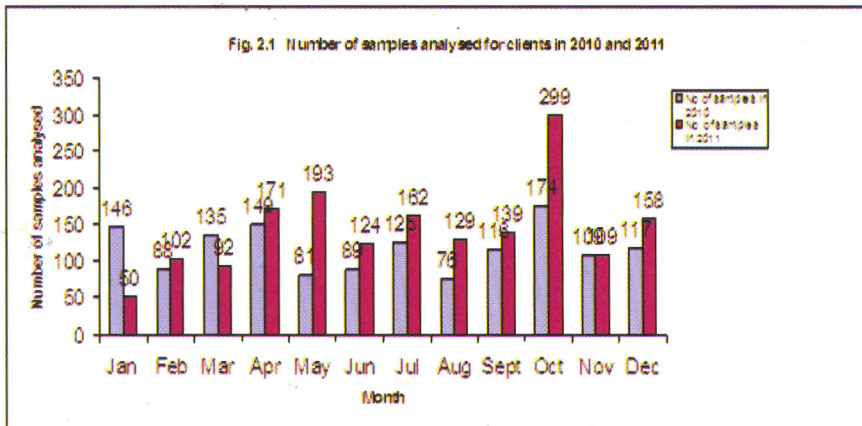
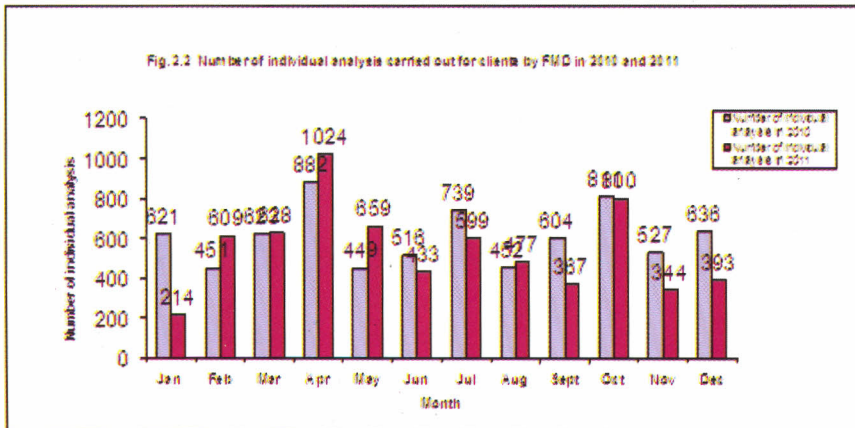
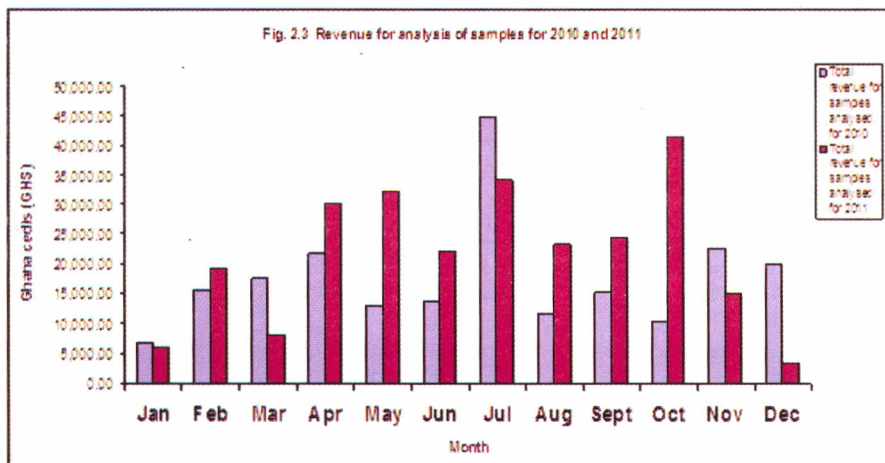


Fig. 6.2 Number of individual analysis carried out for clients by ISU in 2010 and 2011



Revenue obtained from analytical services carried out by ISU for clients in 2010 was GHS 212,440.30 as compared to GHS 258,753.80 in 2011 (Fig. 2.3). The 2011 figure was an improvement of 22% over 2010 revenue.

Fig. 6.3 Revenue for analysis of samples for 2010 and 2011



### Laboratory Quality Management System: ISO 17025 Accreditation

The quality of analytical services carried out for clients was assured by maintenance of the ISO 17025 for which the Food Microbiology Division has accreditation for 11 analytical methods namely:

- Enumeration of Yeasts and Moulds. ISO 7954, 1987 (E).
- Enumeration of presumptive Escherichia coli. ISO 7251, 2005.
- Detection of Salmonella. NMKL No.71, 1999, 5th Ed.
- Coliform bacteria detection in foods. NMKL No.44, 2004 6th Ed.
- Determination of Bacillus cereus in foods. NMKL No.67, 2003.
- Determination of aerobic microorganisms. NMKL No.86, 1999.
- Detection of thermo-tolerant coliform bacteria in foods after pre-incubation
- Enterococcus determination in foods. NMKL No. 68, 2004 4th Ed.
- Aerobic microorganisms and presumptive Enterobacteriaceae enumeration on surfaces and utensils No. 5 2001 5th Ed.
- Microbiological examination of fully preserved canned foods aerobic and anaerobic. NMKL No. 59 2004 5th Ed.

Enumeration of coagulase positive *Staphylococcus aureus* in foods. NMKL No. 66.2003

Two internal audits of the quality system were carried out during the year. Two Management Review Meetings were also held during the year. Staff of the Division who carried out analytical services participated in the Proficiency Testing Scheme organized by Bio Services Ltd. U.K. and performed satisfactorily.

### Activities and Output of Mushroom Unit (MU)

The main activities carried out in the Mushroom Unit are commercial production and sale of mushroom spawns, compost bags and occasionally some fresh mushrooms to clients. Research activities in indigenous and exotic edible and medicinal mushrooms are also carried out by the Unit.



The number of bottled spawns and compost bags produced and sold monthly in 2010 and 2011 to mushroom growers are as shown in Figs 1.4 and 1.5 respectively.

Fig. 6.4 Number of bottled spawns produced per month in 2010 and 2011

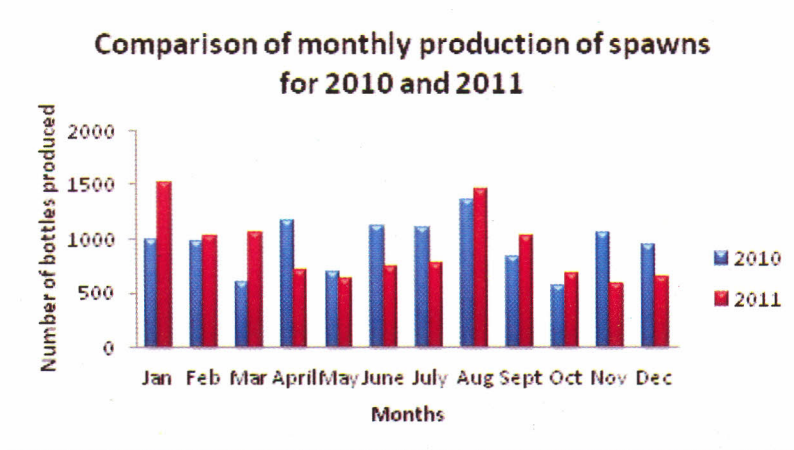
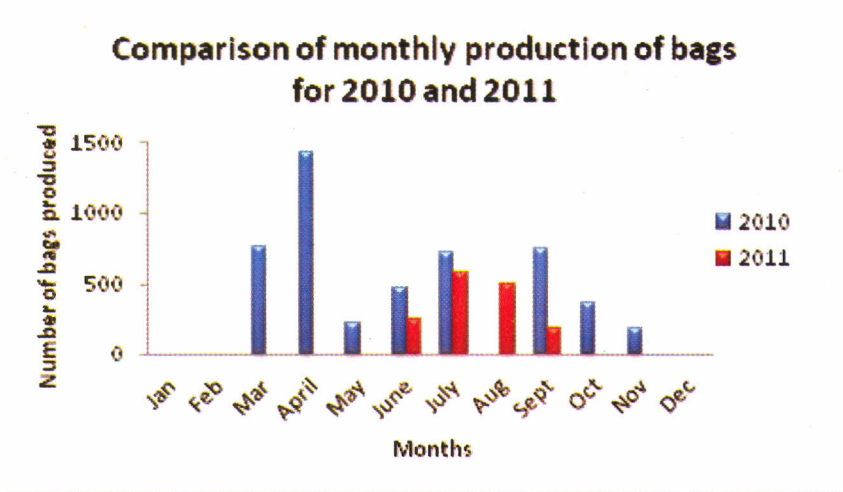


Fig. 6.5 Monthly production of compost bags in 2010 and 2011



### Regular and Vacation Training programmes



Students from tertiary institutions are trained in laboratory procedures and quality management. Intensive and refresher training programmes are also carried out in mushroom cultivation for clients. Third year KNUST students of the Department of Food Science undertook internship programme in the Division.

### Research projects carried out

Several research projects were carried out in the Division. These are as listed below:

1. Evaluation of disinfectant for microbial decontamination of the microbiology laboratory floor by an in-use test.
2. Monitoring of microbiology laboratory working environment.
3. Micronutrient enrichment of meals fed to pupils using highly nutritious and low-cost underutilized fish under the school feeding programme in Ghana.
4. Development of high yielding strains of *Pleurotus* species through hybridization
5. Growth and yield performance of exotic species and strains of *Pleurotus* cultivated under Ghanaian conditions part 2- P9(RL), P8(Rh), PPO, POT, EM-1



6. Utilization of dried pineapple rind *Ananas comosus* var. md2 in the cultivation of the oyster mushroom –*Pleurotus ostreatus* (Jacq.ex.fr) kummer.
7. Studies on the optimum nutrient and environmental growth conditions on the medicinal mushroom (*Lentinula edodes*)
8. Growth and yield performance of different exotic strains of eight *Pleurotus* species cultivated on *Triplochiton scleroxylon* in Ghana.
9. An in vitro evaluation of *Pleurotus ostreatus* EM-1-modified maize (*Zea mays*) cob as a non-conventional energy source for livestock in Ghana.
10. Growth and yield of three *Pleurotus* species on rice straw
11. The Efficacy of Sorghum and Millet Grains in Spawn Production and Carpophore Formation of *Pleurotus ostreatus* (Jacq. Ex. Fr) Kummer
12. Influence of rice husk on biological efficiency and nutrient content of *Pleurotus ostreatus* (Jacq. ex. Fr.) Kummer.
13. Edible and medicinal mushrooms as functional foods in Ghana
14. Phenology of mycoflora and some physical and organic composition of agricultural waste used in the cultivation of the mushroom *Volvariella volvacea*.
15. Biodiversity, Ecology and Uses of larger fungi (Macromycetes, Basidiomycota, Fungi) in West Africa.
16. Cultivation of the oyster mushroom (*Pleurotus ostreatus*) on cellulosic residues from rice straw.
17. Report on advisory services for NutieRich Food Products, Adukrom, Ghana.
18. Report on Mushroom Training Workshops (2008-2011)
19. Steps in oil palm mushroom cultivation in Ghana
20. Introduction to edible and Medicinal mushrooms

## 7.0 FOOD NUTRITION AND SOCIO-ECONOMICS DIVISION

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### Introduction

The mandate of FNSSED is to conduct nutrition and food utilization studies as well as conduct feasibility studies into the economic viability and socio-economic impact of on-going projects in Food Research Institute. The Food Nutrition and Socio-economic Division (FNSSED) has two units, Nutrition and Socio-economic Units. Key activities carried out during the period include product development, recipe formulation, sensory evaluation and analysis, training and community nutrition outreach. Research scientists and technical staff in FNSSED played major supporting but critical roles in on-going projects. Major activities include community nutrition outreach and training on micro-nutrient fortification programme sponsored by WFP, training on improved technologies and utilisation of cassava under the Cassava: Adding Value in Africa (C:AVA) and, socio-economic studies under AfricaRice and Rice Sector Support Projects. Other performance related activities are efforts made on proposal writing, technical reports and publications as well as presentations at conferences.

### Major Activities

- a) Contribution to on-going projects (Supportive and Critical Roles in project implementation.) *Under the West African Agricultural Productivity Programme (WAAPP).*

For this project, activities carried out include:

- Participation in project planning and implementation meetings,
  - Development of a detailed project monitoring and evaluation framework,
  - Beneficiary screening and selection in the Western, Central and Greater Accra Regions,
  - Drafting of beneficiary screening and selection report,
  - Socio-economic Baseline Survey under WAAPP (Baseline survey of community bakers and educational institution matrons conducted in the Agona Nkwanta, Ahanta West District of the Western Region and Kasseh in Dangme East District of the Greater Accra Region, and
  - Entry and analysis of Socio-economic baseline data.
- b) CIDA-funded AfricaRice Project  
These include:
    - Participation in the Higher-level project inception workshop in Cotonou, Benin
    - Participation in FRI-AfricaRice Project inception planning meetings and consequently in-country project launching on the 16th of August, 2011.

- Contribution to drafting of report on project launching
- Preparation towards training on value chain analysis being organized by the Catholic Relief Services and the AfricaRice.
- Participation in value chain and experimental training workshops

c) Rice Sector Support Project

- Socio-economic Baseline and Needs Assessment Survey in Upper West and Northern Regions completed. Key activities involved in were as follows:
  - Questionnaire development, pre-testing and multiplication,
  - Pre-survey arrangements and data collection,
  - Data inputing and analysis,
  - Establishing benchmarks for impact tracking and report writing,
  - Writing of Technical reports to Project Coordinating Unit.

d) Community Nutrition Outreach (In collaboration with Food Processing and Engineering Divisions)



Under the Community Outreach on Micro-nutrient fortifications program in Northern Ghana sponsored by the World Food Programme (WFP), a key activity included : Training workshops organized in 17 communities in the Upper-East, Upper-West and Northern Regions of Ghana. A staff from the Division was involved in training activities and report writing.

e) **Sensory Evaluation and Product Development**

Sensory Evaluation conducted in support of on-going projects were for:

- Seidubille yam samples were received from WIAD for Recipe development. Blanched and unblanched yam flours produced were used to prepare seidubille savouries, Weaning formulations and instant fufu flours dishes
  - Yam products under WAAPP PROJECT
  - Five different species of fish (FISH PROJECT) four local dishes prepared from four different species of fish powder namely flying gournard, anchovies, wevi and tuna frames.
  - Data entry and Analysis of C:AVA cassava flour product acceptability testing
- Sensory evaluation in support of Students' Projects on:



- Rock buns / Effect of sour soup derived fat replacer on the sensory, nutritional and rheological properties of rock buns (for Josephine Oforiwaa Ampofo, an M.Sc. Student from KNUST)
- Brukutu(M.Sc Project, Mrs. Amy Atter)

## Training

### a) *Training of community bakers in the Central Region*

Some Staff of the Division were involved in training of twenty bakers in the Central Region under West African Agricultural Productivity Project (WAAPP). Community bakers were trained in the utilization of alternative flours in bakery products and other snacks in June 2011.

### b) *Training of community bakers in Agona Nkwanta, Ahanta West District of the Western Region*

Community bakers in Agona Nkwanta, Ahanta West District of the Western Region were trained on the use of cassava, sweet potato and cowpea flours, from 18th to 21st July, 2011. The project team purposively identified and invited 25 pastry producers in the Ahanta West District, out of which 24 turned up. The trainings touched on the use of cassava, sweet potato and cowpea flours as substitutes (30 - 100%) to wheat flour in the production of bread, queen cake, cookies, 'chinchin', 'togbee' and strips. Generally, products came out nicely and appreciably with great baker enthusiasm, in spite of minor challenges, such as immediate availability of the flours which needed to be addressed. Entire programme was adjudged a success as bakers indicated acquisition of extra practical knowledge.

### c) *Training of community bakers in Kasseh, Dangme East District of the Greater Accra Region*

Community bakers in Kasseh were trained on the use of cassava, sweet potato and cowpea flours, from 22nd August to 1st September, 2011.



Twenty-five (25) pastry producers were invited out of which 20 honoured the invitation. Participants were also introduced to the production of bread, strips and queen cake using cassava, sweet potato, corn and cowpea flours either in composite or complete substitution of wheat flour. Products here also came out successfully and were well appreciated by the participants. A major concern had to do with availability of the flours.



d) ***Training of matrons of selected Senior High Schools and Training Colleges***

Matrons of selected boarding schools in the Western, Central and Greater Accra Regions were invited to Accra for training on the use of cassava, sweet potato and



cowpea flours. Participants were introduced to the use of cassava, sweet potato, corn and cowpea flours in the production of bread, cake, biscuit, 'togbee' and strips. The result was that of excitement and enthusiasm to try what they have learnt from the hands on demonstrations. Again, viable avenues for the supply of the flours are not instituted yet and remain a major bottleneck to immediate uptake of the technologies.

e) ***Training of FRI Staff on Sensory Evaluation***

Staff in the Division assisted a Consultant to train FRI staff in sensory evaluation and analytical reporting. This took place from 9th – 27th May, 2011.

f) ***Training of Other Clients***

The underlisted training programmes were conducted during the reporting period

- Training of 2 clients in soybean products in April, 2011.
- Training of 2 staff members of the Institute of Food Technology Dakar Senegal in HQCF products in 6th – 10th June 2011
- Training of students of School of Allied and Health Sciences in recipe development and sensory evaluation (both theory and practicals) in June 2011

**Commercialization Activities**

Commercialization activities in FNSD involved Sale of research by-products, weight management services & nutritional counseling, catering and data entry services. Within the year, income was generated from sale of research by-products (GHS778.50), catering (GHS300.00) and data entry services (GHS540.00).

## **8.0 PROGRAMMES AND PROJECTS**

### **8.1 Accreditation, Food Safety And Quality Assurance Programme**

#### **Introduction**

In May 2007, four (4) chemical and eleven (11) microbial laboratory analyses methods of the CSIR-Food Research Institute were accredited by the South African National Accreditation System (SANAS) to ISO/IEC 17025. By this accreditation, tests are done in accordance with ISO/IEC 17025 standards and for that matter, results from the Institute's laboratories by use of these fifteen (15) accredited methods should be accepted as credible worldwide.

#### **Outcome of Surveillance visit (2011)**

As part of its periodic assessment of accredited facilities, SANAS audited the Quality Manager, as well as Industrial Services Units of both Food Microbiology and Food Chemistry Divisions on 11th January, 2011. In all, eight (8) non-conformances were recorded as follows: The Quality Manager's Office recorded one (1) major and three (3) minor non-conformances. The Industrial Services Units of Food Microbiology and Food Chemistry Divisions recorded three (3) major non-conformances and one (1) minor non-conformance respectively.

These non-conformances have since been addressed.

#### **Major Activities**

##### **Internal Audits**

In accordance with ISO/IEC 17025 standards, two internal audits were conducted in the laboratories and other units that support the implementation of ISO/IEC 17025 standards by the laboratories. These audits were conducted in March and September. The audits were carried out by Dr. Charles Tortoe (Lead Auditor), Mr. Elvis Baidoo, and Dr. Lawrence Abbey (Quality Manager).

The audit findings were as follows:

Eight (8) conformances were recorded by the Industrial Services Unit in the first audit. In the second audit, seven (7) conformances were recorded.

The Industrial Services Unit of the Food Chemistry Division recorded two (2) non-conformances in the first audit and six (6) non-conformances in the second audit.

The Toxicology Unit of the Food Chemistry Division recorded one (1) conformance in the first audit and three (3) non-conformances in the second.

The Customer Service had five (5) non-conformances in the first audit and three (3) non-conformances in the second. Two (2) conformances were recorded by the Stores (Accounts Division) and three (3) in the second audit. These non-conformances have since been addressed and preventive actions being adhered.

### **Management Review Meetings**

The 16th and 17th Management Review meetings were held on the 22nd of June, and 9th November respectively. Major decisions that border on Quality system such as non-conformances, corrective and preventive actions, improvements, among others were taken at these meetings.

Members of the Management Review Meeting included the Director (Chairperson); Deputy Director; Heads of Food Microbiology, and Food Chemistry Divisions; Heads of Commercialisation and Information, Accounts and Administration Divisions; as well as the Quality Manager as Member/Secretary.

### **Participation in proficiency tests/inter laboratory comparisons**

#### **Proficiency Tests**

As prescribed by ISO standards, accredited methods were subjected to proficiency testing. The Chemistry laboratory performed satisfactorily in tests run on sample ordered from Food Analysis Performance Assessment Scheme (FAPAS) of the Central Science Laboratory of the United Kingdom in November 2011.

#### **Notification of surveillance**

The Quality Manager received a confirmed notification of surveillance assessment from SANAS. This assessment as per the schedule was on January 11th, 2011 and covered the Quality Manager's office as well as the Food Microbiology and Chemistry laboratories.

## **8.2 Projects**

### ***a) Cassava: Adding Value for Africa (C:AVA) Project***

**Summary:** The project aims to significantly boost the incomes of small-scale African farmers by linking them to new markets. This goal is expected to be achieved through the use of innovative interventions to capacitate farmers, village processing units and market intermediaries to competitively deliver high quality cassava-based products to



a well sensitized market. From the initial stages of the contract, the project was targeted to end in March 2011; however, it has been given a two (2) year low cost extension, thus it is estimated to end in the year 2013. The new directive still focuses on improving cassava value chains but is narrowed down to processing, market development and credit management excluding production activities. This reduces stakeholders from ten (10) to eight (8) with the exclusion of Ministry of Food and Agriculture (MoFA) Brong Ahafo and Volta Regions.

**Estimated duration:** 2 years

**Sponsors:** Bill and Melinda Gates Foundation

**Budget:** USD 504,967.00

**Location:** Greater Accra, Brong Ahafo and Volta Regions

**Principal Investigator:** Dr. Nanam Tay Dziedzoave

**Participating scientists:** Mr. Victor Antwi

**Participating Technologist(s):** Mrs. Beullah Sallah

**Collaborating Institutions:**

- Associates for Sustainable Rural Development (Ho)
- Progressive Youth in Community Development (Hohoe)
- Christ Apostolic Agency for Rural Development (Atebubu)
- Social Development and Improvement Agency (Bechem)
- Association of Africa women in Development (Sunyani)
- Forestry Research Institute of Ghana- FORIG- (Kumasi)

**Background information and justification:** Through an initiative led by the University of Greenwich's Natural Resources Institute, UK, in close partnership with the Food Research Institute, Ghana, the Bill and Melinda Gates Foundation is funding a 3 year project on cassava-“ Cassava: Adding Value for Africa”- in Ghana. Four other African countries-Nigeria, Uganda, Tanzania and Malawi-are also beneficiaries of this initiative. This project was set up to develop the cassava value chain and to maximize achievements in the cassava sub-sector.

**Objective(s):** The project aims to significantly boost the incomes of small-scale African farmers by linking them to new markets.

**Expected beneficiaries:** Cassava farmers, processors and end users

**Expected outcome:** C: AVA-Ghana will develop value chains for High Quality Cassava Flour (HQCF) in Ghana, to improve the livelihoods and incomes of at least 20,000



smallholder households as direct beneficiaries including women and disadvantaged groups, it will promote the use of High Quality Cassava Flour (HQCF) as a versatile raw material for which diverse markets have been identified in pilot studies. The project will focus on three potent intervention points:

- Ensuring a consistent supply of raw materials;
- Developing viable intermediaries acting as secondary processors or bulking agents in value chains and
- Driving market demand and building market share (in, for example, bakery industry, and components of traditional foods or plywood / paperboard applications).

Farmers and farmer/ processors will be supported in production and primary processing activities through partnership with NGOs, identifiable service providers or other extension services. Business development and other specialists will support intermediaries to meet the requirements of end users. End users will be supported technically in adopting HQCF.

**Progress made so far:**

- 10,518 tons of fresh cassava was moved through the value chain for the production of:
  - 30 tons of high quality cassava grits
  - 273.6 tons of HQCF
  - 259.12 tons of kokonte and
  - 1473.1 tons of gari all of which was effectively marketed to various end-users.
- Additional markets were secured.
- The production of a 30-minute documentary titled 'High Quality Cassava Flour-The Hidden Treasure in Cassava' was completed during the period under review.
- As part of an intensive mass media campaign the documentary was aired on Ghana Television and published in a newspaper publication.
- The Project Management Team, The Country Coordinator and the President of the Cassava Flour Producers Association of Ghana (CAFPAG) held a meeting with the Deputy Minister of Trade and Industry, Hon. Dr. Joseph S. Annan, to discuss issues relating to the inclusion of cassava flour into wheat flour at source.
- The Project Management Team of C:AVA-Ghana served on the Local Organizing Committee of the West Africa Root and Tuber Crops Conference which was held from the 12th -16th of Sept 2011, in Ghana. The C:AVA-Ghana team played a very significant role in the entire organization of the conference which came off very successfully.

- Gradually, the concept of using HQCF/Grits as poultry and pig feed substitute is gaining ground as farmers are beginning to understand the concept while waiting for the performance of the pilot usage of the product.
- Two poultry farmers in Kumasi, (Premier Farms and Asamoah & Yamoah Farms) as well as the Pig Farmers Association at Ejisu-Juabeng have received pilot supply of HQCF/Grits for test trials in their various farms.

Table 8.2.1 A table of achievements against targets

Indicators	Target	Achievements
Farmer Mobilization (No.)	20,000	13,052
Farmer Income (\$/farmer/yr)	190	69
HQCF Produced and Sold (MT)	11,290	1,175
Other Cassava Products (MT)	0	10,685
Credit Access (\$)	209,000	153,624
Credit Beneficiaries (No.)	20	8
Total Market Access (MT)	11,290	11,860

**b) West African Agricultural Productivity Project (WAAPP)-Use of alternative food flours for baking-Capacity and capability building of local bakers and educational Institution in coastal communities**

**Summary:** To aid improve export competitiveness, biodiversity, land administration and management, technology diffusion, trade facilitation and market access, the West African Agricultural Productivity Project (WAAPP) was born. The focus of this project is on making agriculture more productive and sustainable and to promote regional integration initiative in the agricultural sector. It reflects the World Bank's commitment to Africa's regional cooperation in agriculture and will be one of the Bank's key contributions to the implementation of broadly supported agricultural strategies Africa-wide. WAAPP would significantly go a long way to raise agricultural yield which are so important in meeting the Millennium Development Goals of halving extreme poverty by 2015.

This project is about transferring flour technologies to bakers, matrons of SHSs and cassava processors in Western, Central and Greater Accra Regions so as to reduce the cost of wheat flours used in production of bread and other pastries.

**Estimated duration:** 1 year, 6 months

**Sponsors:** World Bank- WAAP Budget: USD 15 million

**Location:** Western Region (Ahanta West), Central Region (Mfantseman District), Greater Accra Region (Dangbe East)

**Principal Investigator:** Dr. Nanam Tay Dziedzoave

**Participating scientists:** Mr. Peter Addo, Mr. Eric Sarpong Owusu

**Participating Technologists/Technicians:** Mrs. Iris Tamakloe, Mrs. Constance Boateng, Mrs. Alice Padi, Ms. Paulina Addy (MoFA)

**Collaborating Institutions:** Ministry of Food & Agriculture (MoFA) - District offices in above Districts

**Background information and justification:** The demand for food in Africa outweighs the quantity of food available. This implies that, food production has failed to keep pace with population growth of many countries on the continent. Roots and tuber have a high potential of reversing this trend if improved. According to MoFA, yield per unit area of these commodities are low. Information from CSIR-Crop Research Institute shows that roots and tubers account for approximately 40% of Ghana's Annual GDP.

With support from the World Bank, ECOWAS initiated WAAPP to ensure a successful execution of its agricultural policy and to overcome agricultural challenges.

Over the years, there has been the increasing cost of production in baking. There was thus the need to formulate flours from alternative resource substitutes to reduce cost. As a result, this project aims at making a 15% savings on raw materials for the production of bread and other pastry products by substituting wheat flour with high quality cassava flour, Sweet potato, corn and cowpea flours.

#### **Objective(s)**

- To enhance the technical capacity of 60 bakers in 6 communities in Central, Western and Greater Accra Regions in the use of alternative flours in bread and selected pastry products.
- To develop the capacity of matrons in 35 SHS and 5 Teacher Training Colleges in the above mentioned regions in the use of alternative flours in students' bread.
- To develop the capacity of 15 local cassava processors to produce alternative flours for bakers



**Expected beneficiary:** Cassava farmers, processors and end users

**Expected outcome:** To reduce the cost of production of bread and other pastry products.

**Progress made so far:**

- A West Africa Root and Tuber Crops Conference was held to:
  - Increase contribution of the WAAPP to national development by spearheading the purposeful implementation of conference recommendations.
  - Contribute to the achievement of the MDGs-the eradication of extreme poverty- in root and tuber producing communities.
  - Increase the contribution of root and tubers to the National Agricultural GDP.
- Increased production: 86% for cassava, 35% for yam and marginal increase for sweet potato and cocoyam.
- Increased availability of disease resistant planting material.
- Increase in markets for Root and Tuber crops, e.g. Cassava for starch-based industry and livestock feed.
- Over ten private companies are regularly producing and marketing HQCF and other root and tuber products.
- Quality of Root and Tuber products on the market has been significantly improved
- Several equipment manufacturers are now specialized in the fabrication and marketing of root and tuber processing equipment (e.g. Cassava graters, pressers and dryers).

**c) CIDA-funded/AfricaRice Project on Rice post-harvest handling, marketing and the development of new rice-based products**

**Summary:** The ultimate outcome of this project is to increase food security and sustainable livelihoods among rice value chain actors in Africa. To achieve this, the project will introduce improved harvest and post-harvest rice processing practices and technologies to upgrade the quality and marketability of locally produced rice in order to meet urban consumers' preferences. The project will also promote the development and adoption of new rice-based products. Moreover, to foster an enabling environment for regional rice production and trade, the project will provide technical advisory and policy guidance support to the regional economic communities in sub-Saharan Africa.

The activities of this project will be carried out in Cameroon, The Gambia, Ghana, Mali, Nigeria, Senegal, Sierra Leone and Uganda. The nature of project activities in each country will depend on the specific country needs and circumstances.

**Estimated duration:** 5 years



**Sponsors:** Canadian International Development Agency (CIDA)

**Location:** Afife, Atebubu, Navorongo

**Principal Investigator:** Dr. P-N.T. Johnson

**Participating Scientists:** Mr. Joseph .K. Gayin, Mrs. Wilhemina Quaye, Mr. Eric Owusu, Mr. Charles Diako, Mrs. Ruth Pobee, Ms. Hannah Oduro

**Participating Technologist(s):** Mr. Ali Sampare, Mr. Isaac Apollonius Nyarko, F. Mboom

**Collaboration Institutions:** McGill University, NARS, CSIR-SARI, CSIR-CRI, Ghana Rice Inter-professional body, Sinapa Aba (Micro-finance), Selassie Farms (Secondary Processor), TechnoServe, University of Ghana--Departments of (Nutrition & Food Science and Crop Science), MoFA, MoTI- NBSSI, Single Mothers Rice Processors (Primary Processor), GRATIS Foundation (Processing equipment), Institute of Packaging Ghana, Consumer Association of Ghana

**Background information and justification:** In response to global food crises, CIDA has developed a Food Security strategy which focuses on Food aid and nutrition, Sustainable agricultural development and Research and development. The aim of this project is in alignment with CIDA's "Food security" priority theme for Africa and its contribution to research and development. The measures taken through research and development will give farmers in partner countries better access to the new technologies and specialized expertise they need for their farming operations, to keep pace with the growing demand for food.

Rice has become an important staple for both rural and urban dwellers and is gradually taking over from traditional crops such as root and cereal crops. Ghana therefore spent \$218 million as at 2009 for the importation of rice. Despite the efforts made in local rice production the cost of production is high and uncompetitive in the domestic market due to relatively cheaper imported rice. The high local demand for foreign rice is crowding-out local farmers and processors from their own domestic market resulting in jobs loss, poor quality livelihood and increased food insecurity among rice farmers and other value-chain actors. There is therefore the urgent need for intervention in the rice industry to ensure proper post harvest handling and marketing.

**Objectives:** To introduce improved harvest and post harvest rice processing practices and technologies to upgrade the quality and marketability of locally produced rice to meet Sub-Saharan African consumers' preferences.

**Expected beneficiaries:** Small-holder rice producers, women rice parboilers, local artisans, local rice traders, scientists and agricultural extension staff

**Expected outcome:**

- Increase access to improved harvest and post-harvest rice processing practices and equipment for farmers, millers, parboilers and marketers in “good-practice concentration areas” of targeted countries.
- To increase applied knowledge of rice producers, processors and consumers in new rice-based products developed from slower-digesting varieties, broken rice fractions and rice by-products.
- Rice value-chain actors in target countries would have enhanced applied knowledge of improved harvest and post-harvest rice processing practices and the making and use of new value-added rice-based products and by-products.
- Improve evidence-based rice policy formulation and adoption by policy-makers in targeted pilot countries.
- Increase coordination and harmonization of regional rice policy in the Regional Economic Communities.
- Scientists and agricultural extension agents in selected pilot countries would have increased applied knowledge on rice harvesting, processing, marketing and policy analysis.

**Progress made so far:**

- The project website has been launched
- An inception workshop was organized

**d) African Food Tradition Revisited by Research (AFTER) Project**

**Summary:** The African Food Tradition Revisited by Research (AFTER) Project aims to revisit traditional African products, knowledge and know-how in the light of new technologies for the benefit of consumers, producers and processors in Africa and Europe. By applying European science and technology to African traditional food products, AFTER seeks to turn research into quantifiable and innovative technologies and products

that are commercially viable in both European and African markets. The 10 selected products representing 3 families of foods (fermented cereal-based, fermented salted fish and meat, & vegetable and fruit based functional foods) fit into a matrix of technologies and processes shared between Europe and Africa that will be jointly developed within the framework of AFTER.

Creating new markets and trade opportunities for improved traditional foods and novel products in Europe and Africa will increase economic returns for all stakeholders involved in the production chain, down to the community level. Due consideration will be accorded to regulatory, ethical and IPR issues while also protecting the intellectual rights of Africans.

In Ghana, the dehulled kenkey will be characterized according to existing knowledge on technologies and processes. The improved product, produced through reengineering and new processing technologies, will be tested for consumer acceptance, safety and nutritional quality. The market and entry requirements for new kenkey will be assessed. Involving EU and African companies in production trials for the improved product will translate the results into ready-to-use information for food companies.

**Estimated duration:** 4 years

**Sponsors:** European Union- Seventh Framework Theme

**Location:** Greater Accra, Central and Eastern Regions

**Principal Investigator:** Dr. Wisdom Kofi Amoa-Awua

**Participating Scientists:** Dr. Mary Obodai, Mrs. Charlotte Oduro-Yeboah, Mr. George Anyebuno, Mr. Charles Diako, Mr. Hayford Ofori

**Participating Technologist(s):** Mr. Theophilus Annan

**Collaborating Institutions:** Ministry of Food and Agriculture- Women in Agricultural Development, University of Ghana, Legon

**Background information and justification:** Kenkey's importance in modern-day life is underlined by the wide spectrum of fermented foods marketed both in developing and industrialized countries, not only for the benefit of preservation and safety, but also for their highly appreciated sensory attributes. The process of kenkey-making is lengthy and laborious; therefore it is more often purchased from a commercial kenkey producer rather than cooked at home. The producers who are mainly women with little or no formal education— carry out commercial production as a family-acquired art. In a survey



conducted in Accra, Allotey (1996) found that at most production sites the amount of maize processed weekly ranged from 0.05 to 1.2 metric tons with an average of 0.3 tons of maize processed into 0.5 tons of kenkey. There are however, a few large production sites with weekly capacities of several tons (up to 5 tons) of maize. The production of kenkey is based on traditional technologies that have been handed down in generations.

Commercial production and street vending of kenkey is the source of livelihood for many traditional food processors and food vendors in Ghana and these activities make a sizeable contribution to the rural and urban economy in Ghana. Kenkey, as a street food is convenient, cheap, and affordable for the poor and provides informal and self-employment opportunities as well as supplementary income for households. The vending of kenkey contributes positively to the food security of all the actors in the value chain including maize farmers, input suppliers, kenkey processors and vendors. The market for kenkey was originally limited to Ghana but recently it has a niche market in the Diaspora including some West Africa countries. There is however a possibility for further extension to the international markets.

This study is part of an European Union collaborative project between CSIR-Food Research Institute, four European countries and seven African countries. It will directly contribute to improving the competitiveness of traditional products and facilitate the implementation and uptake by food companies. Beyond these direct results, the lessons learnt and the methodologies for the assessment of traditional products and processes will be shared with other countries worldwide in order to disseminate the results among the research community involved in food research in developing countries.

**Objective(s):**

- To reach comprehensive scientific knowledge of the existing know-how on technologies, processes and products.
- To propose improved traditional processes by reengineering of the unit operations with the aim of improving the safety and nutritional quality while keeping or improving the organoleptic characteristics of traditional products.
- To reach objective criteria of acceptability of the traditional products by the consumers and to ensure that the products can effectively access the EU markets in view of regulatory and ethical issues while protecting the intellectual rights of the people in Africa.
- To present the results into ready-to-use information for food companies including SMEs via guidelines on quality management, food law and regulation and consumer protection and to transfer the results to the stakeholders from Africa and from the EU.



**Expected beneficiaries:** Consumers, producers and processors in Africa and beyond  
Food companies including SMEs

**Materials and Methods:** Survey methodology

A semi-structured questionnaire was administered to producers, sellers and consumers of kenkey. The questionnaire aimed at gathering information about the production, vending and consumption of kenkey in Ghana in order to identify the major problems and bottlenecks related to kenkey so as to investigate some of them and propose adequate solutions.

The total sample size of the respondents to be interviewed for the whole geographical region was calculated using  $N_i = 4X \pi(1-\pi)/d^2$

$N_i$  is the total number of respondents to be surveyed for the study (Chadare et al, 2008).

$$\pi = np/N_t$$

$\pi = np/N_t$ ; the proportion  $np$  of the product producer, seller and consumer among the  $N_t$  randomly interviewed persons and  $d$  is the expected error margin fixed at 0.05 (Dagnelli, 1998). Based on the calculation above, the total number of consumers to be interviewed was three hundred and fifty four (354), producers was two hundred and thirty two (232) and sellers was two hundred and nine (209).

**Expected outcome:** To improve traditional African products in the light of combined and/or new technologies for mutual benefits for the consumers, the companies and the producers of Africa and Europe.

**Progress made so far:**

- A survey which concentrated on the problems facing kenkey producers and marketers and also, to ascertain consumer perception was conducted.
- The survey results on kenkey were presented at the Annual coordination meeting in France.
- There was a workshop to review the various activities each country on board was to concentrate on so as to begin the implementation of project activities.
- The Ghana chapter came out with standard operating procedures for mycotoxins, antimicrobial activities etc of dehulled kenkey.

- A work study was done on the unit operations of dehulled (white) kenkey at South Senchi in the Eastern Region.
  - A review of the regulatory and compliance environment was prepared.
- e) **Micronutrient enrichment of meals fed to pupils, using highly nutritious and low-cost underutilized fish under the school feeding programme in Ghana.**

**Summary:** Four underutilized fish species, namely woevi or 'one-man-thousand' (*Sierathrissa leonensis*), flying gurnard (*Dactylopterus volitans*), common bogue (*Boops boops*) and anchovies (*Anchoa guineensis*); as well as tuna frames were used. They were solar and mechanically dried, milled into powder and analyzed for proximate, mineral content, biochemical, microbiological, sensory and shelf life. Characterization of the fish species showed that they are of high nutritional significance in either human food supplements or formulations. They showed high protein content, good general amino profile, abundance of polyunsaturated fatty acids, and a unique source of micronutrients, particularly minerals. The high nutritional value of the products showed their potential for food supplementation in the school feeding programme, although generally these products might be regarded as fish for the poor. Overall acceptability by the school children rated all the foods on the positive side of the hedonic scale, especially banku with anchovies okro stew, rice with tuna frames stew and rice with flying gurnard stew.

**Estimated duration:** 1 year

**Sponsors:** United Nations-Food and Agricultural Organization (UN-FAO)

**Budget:** \$10,000

**Location:** Accra, Ghana

**Principal Investigator:** Dr. Margaret Ottah Atikpo

**Participating Scientists:** Dr. Lawrence Abbey, Mrs. Mary Amengor, Mrs. Linda Hagan

**Participating Technologists/Technicians:** Technologists in CSIR-FRI Microbiology lab, Chemistry lab, Test Kitchen; CSIR-WRI; ECOLAB, Legon

**Collaborating Institutions:** CSIR-WRI and ECOLAB, Legon

### **Background and Justification**

Inadequate food supply in terms of meeting the energy requirements affects at least 925 million people worldwide. More than two billion people are affected by micronutrient deficiency, prevalent in poor rural and urban areas. Micronutrient deficiencies are

connected to low dietary intakes of vitamin A, iron and iodine or non-availability of selenium, zinc and calcium in the diet; e.g., zinc deficiency contributes to death of 800,000 children globally per year and rickets which is caused by calcium deficiency.

Fish products are a good source of many of the micronutrients with levels of most minerals found in significant amounts in fish bones. An increased use of seafood, including bones, could contribute significantly to reducing the level of micronutrients and protein malnutrition.

**Objectives:** To increase the nutritional status of school children in Ghana using locally processed fish products of low cost and high nutritional value.

**Expected beneficiaries:** School children, adolescent girls, women of childbearing age

**Progress made so far**

All analyses have been completed, except shelf life studies yet to be done.

**f) Development and optimization of choco-peanut spread and development of high quality stabilized peanut butter.**

**Summary:** In recent years, nuts have received considerable attention as one of the foods that have beneficial effects for cardiovascular health. As a measure to curb post harvest losses of peanuts, its development into spread and butters have gained much recognition, thus, the research to improve this product development.

**Estimated duration:** Two (2) years

**Sponsors:** Global Peanut Product Processing and Marketing team (UGA-GP3MT) - University of Georgia.

**Budget:** USD 3,000.00

**Location:** CSIR-FRI

**Principal Investigator:** Mr. Charles Diako

**Participating Scientists:** Mrs. Evelyn Buckman

**Participating Technologist:** Mr. Emmanuel Saka

**Collaborating Institutions:** University of Georgia



**Background information and justification:** The University of Georgia UGA-GP3MT is funded by the Peanut Collaborative Research Support Program (Peanut-CRSP) of the United States Agency for International Development with the University of Georgia at Griffin being the implementing body. CSIR-FRI operates as the Managing Partner of a series of projects being implemented in Ghana under this programme. The program aims at bringing scientists and industry together for collaborative development and transfer of technology through an early engagement approach. The development and optimization of the Choco-peanut spread was implemented with an industry partner who wants to adopt the technology and commercialize the product.

**Objective(s):** To develop and optimize a prototype peanut-based spread with cocoa ready for industrial adoption

**Expected beneficiaries:** Small, medium and large scale industries; food processes.

**Materials and Methods:** Peanuts, sugar, stabilizer, cocoa powder, roaster, oven, refrigerator, colloid mill, blender, plaster jars, sacks and liners, gloves, hair nets and nose masks.

The methods used were mixture designs and optimization methodologies.

**Estimated outcome:**

- To develop and optimize a prototype peanut-based spread with cocoa ready for industrial adoption.
- To develop a stabilized peanut butter for small companies.

**Progress so far:**

- Signed an MOU between CSIR-FRI and Industry collaborator.
- Prototype development and sensory evaluation of prototypes.
- Optimization of selected prototype from sensory evaluation.
- Standardization of the roasting procedure of peanuts for the production of peanut butter.

**g) Tackling Malnutrition in Northern Ghana-Cereal Flour Fortification**

**Summary:** The World Food Programme (WFP) and its partner agencies have long been recognized for their ability to deliver food to deprived and resource –poor people all over the world. Relatively little is known about the efforts it puts in place to check that the food they supply provides vitamins and minerals and not just calories. As a result of that, the technology of cereal flour fortification with micronutrient (vitamin/mineral) premix was



transferred in twelve communities in the Upper East, Upper West and the Northern regions of Ghana. This was organized as part of WFP/UNICEF joint project on Tackling Malnutrition in Northern Ghana using fortification of their staple foods (cereal flour) with six vitamins and two minerals as a means of meeting their nutritional needs. A hand-operated mixer designed and fabricated at the CSIR-Food Research Institute was employed for the mixing process. The training sessions were also facilitated by the use of a poster which showed step-by-step procedures. A Group discussion approach was adopted to help participants feel a sense of ownership of the programme and to also appreciate the intervention.

**Estimated duration:** 2 years

**Sponsors:** CIDA/WFP

**Location:**

- Upper-East Region (Gorogo, Zorko Goo, Tangasia, Chuchuliga Namosa)
- Northern Region (Woribogu-Kukuo, Yilonayili, Gortani, Yankazia, Nansoni)
- Upper-West Region (Lam-Uollo, Ketuo and Dahile-Kpanagaan)

**Principal Investigator:** Mr. Joseph Gayin

**Participating Scientists:** Dr. P-N.T. Johnson, Ms. Hanna Oduro

**Participating Technologist:** Mr. Seidu Ali Sampare

**Collaboration Institutions:** World Food Programme (WFP)

**Background information and justification:** Under nourishment accounts for a third of all deaths in children under the age of five in developing countries annually (WFP, 2011). Micronutrient malnutrition also known as “hidden hunger” due to lack of intake, absorption and utilization of food accounts for 7.3% of the global burden of diseases (Fe, I, Zn, Vit. A). Malnutrition is both a cause and manifestation of poverty. Northern Ghana has the higher percentage of Ghana's poor (WFP/UNICEF report, 2009). In order to aid in poverty reduction, the concept of a deliberate addition of one or more micronutrients to particular foods (usually staples) so as to increase the intake of these micronutrient(s) was born. This was in order to correct or prevent a demonstrated deficiency and provide a health benefit.

**Objectives:**

- To improve the nutritional status of women and children by promoting the flour fortification with micronutrients
- To provide an alternate source of income for women groups through milling and fortification

**Expected outcome:** Improve the nutritional status of malnourished pro-poor farming communities in the selected communities in the northern regions.

**Progress made so far:**

- Design and fabrication of 17 Hand operated mixers
- Preparation of 20 maxi bags of premix at CSIR-FRI using maize, millet and sorghum
- The technology for fortification of cereal flour has been transferred to field officers of WFP.
- Districts / Communities trained within the period under review:
  - Northern Region: Nyohini, Kumfong, Gutingli, Ngani, Wulensi, Latinkpa-Bunjai, Karaga Nyensong.
  - Upper East: Kalbeo, Akuka, Sapelliga, Possum.
  - Upper West: Vamboi, Bullu, Charia, Vieri, Tuna

## APPENDIX I

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### Senior Members and Senior Staff List

#### Directorate

- |                          |   |                             |
|--------------------------|---|-----------------------------|
| 1. Dr. P- N. T. Johnson  | - | Acting Director             |
| 2. Dr. (Mrs)Kafui Kpodo  | - | Deputy Director/ Head-FCD   |
| 3. Robert. M. Yawson     | - | Senior Scientific Secretary |
| 4. Stephen Nketia        | - | Scientific Secretary        |
| 5. Faustina Mante (Mrs.) | - | Prin. Admin Assistant       |
| 6. Mariam Yakubu (Ms.)   | - | Technologist                |

#### Administration Division

- |                                       |   |                            |
|---------------------------------------|---|----------------------------|
| 1. J. Aggrey -Yawson (Ms.)<br>Officer | - | Ag. Head Admin/Asst. Admin |
| 2. Eric K. Ofori                      | - | Prin. Admin. Asst.         |
| 3. Emmanuel A. Larbi                  | - | Chief Works Supt.          |
| 4. Jacob Kuwornu                      | - | Prin. Works Supt.          |
| 5. Isaac Hammah                       | - | Senior Works Supt          |
| 6. Christiana Ketsie (Ms.)            | - | Senior Admin Asst.         |
| 7. Victoria A. Asunka (Mrs.)          | - | Senior Admin. Assistant    |
| 8. Beullah Adadevor-Sallah (Mrs.)     | - | Senior Admin. Assistant    |

#### Accounts Division

- |                          |   |                         |
|--------------------------|---|-------------------------|
| 1. N. Adoboe-Mensah      | - | Head/Accounts Division  |
| 2. C. Aikins Tutu        | - | Chief. Accounting Asst. |
| 3 John M. Nakotey        | - | Chief Stores Supt.      |
| 4. Kenneth K. Aidoo      | - | Chief Accounting Asst.  |
| 5. Judith Dogbegah (Ms.) | - | Chief Accounting Asst.  |
| 6. Christine Amegah      | - | Prin. Accounting Asst.  |
| 7. Derrick V. A. Sallah  | - | Prin. Accounting Asst.  |
| 8. Joseph K. Larbi       | - | Accounting Asst.        |
| 9. Mabel Aryee (Ms.)     | - | Accounting Asst.        |
| 10. James Cromwell       | - | Stores Supt.            |
| 11. Wolase Efordzi       | - | Stores Supt.            |

**Commercialization & Information Division**

- |                           |   |  |
|---------------------------|---|--|
| 1. Dr. Kwame A. Vowotor   | - | Ag. Head/CID (Snr. Research Scientist) |
| 2. Kwabena A. Bugyei      | - | Asst. Scientific Info. Officer         |
| 3. Raphael Kavi           | - | Jnr. Asst Librarian                    |
| 4. Augustine Andoh        | - | Chief Tech. Officer                    |
| 5. Benedict Awotwi        | - | Chief Tech. Officer                    |
| 6. Philip.O. Baidoo       | - | Prin. Accounting Asst.                 |
| 7. Joana B. Dzikunu (Ms.) | - | Snr. Admin. Assistant                  |
| 8. Jeremiah Lartey- Brown | - | Senior Technical Officer               |
| 9. Mary Assimah (Ms.)     | - | Admin. Assist.                         |

**Food Processing & Engineering Division**

- |                             |   |  |
|-----------------------------|---|--|
| 1. Dr. Nanam T. Dziedzoave  | - | Ag. Head/FPED (Prin. Research Scientist) |
| 2. Dr. John T. Manful       | - | Senior Research Scientist                |
| 3. Dr. C. Tortoe            | - | Senior Research Scientist                |
| 4. Dr. Lawrence D. Abbey    | - | Research Scientist                       |
| 5. Ebenezer C. Tettey       | - | Research Scientist                       |
| 6. Cletus K. Gyato          | - | Research Scientist                       |
| 7. Benjamin A. Mensah       | - | Research Scientist                       |
| 8. Joseph Gayin             | - | Research Scientist                       |
| 9. Gregory A. Komlaga       | - | Research Scientist                       |
| 10. C. Oduro-Yeboah (Mrs.)  | - | Research Scientist                       |
| 11. Elvis A. Baidoo         | - | Research Scientist                       |
| 12. Moro Adams              | - | Research Scientist                       |
| 13. Daniel A. Anang         | - | Research Scientist                       |
| 14. Seidu A. Sampare        | - | Chief Tech. Officer                      |
| 15. John A. Asafu-Adjei     | - | Chief. Works Supt                        |
| 16. Rhodes Y. Anthonio      | - | Prin. Works Supt.                        |
| 17. Robert O. Lamptey       | - | Prin. Works Supt.                        |
| 18. Isaac Apollonius Nyarko | - | Senior Technologist                      |
| 19. Emmanuel A. Saka        | - | Technologist                             |
| 20. Edna Mireku (Ms.)       | - | Technologist                             |
| 21. Patrick Mintah          | - | Prin. Tech. Officer                      |
| 22. Peter Delabor           | - | Prin. Works Supt.                        |



- |                            |   |                      |
|----------------------------|---|----------------------|
| 23. Joseph Akoto           | - | Senior Works Supt.   |
| 24. Emmanuel Alorsey       | - | Asst. Technologist   |
| 25. Godwin Armah           | - | Senior Tech. Officer |
| 26. Solomon Dowuona        | - | Senior Tech. Officer |
| 27. Thomas Najah           | - | Senior Tech. Officer |
| 28. John R. Addo           | - | Senior Tech. Off.    |
| 29. Samuel Asiedu          | - | Technical Officer    |
| 30. Makafui Torgbui        | - | Technical Officer    |
| 31. Agartha Amuzu          | - | Technical Officer    |
| 32. Helene A. Annan (Mrs.) | - | Technical Officer    |
| 33. Desmond Mensah         | - | Technical Officer    |
| 34. Jemima Ofori (Ms.)     | - | Technical Officer    |
| 35. Ofori Brempong         | - | Technical Officer    |
| 36. Emmanuel Tettey Agblo  | - | Works Supt.          |

#### **Food Microbiology Division**

- |                                    |   |                                     |
|------------------------------------|---|-------------------------------------|
| 1. Dr. W.A. Amoa-Awua              | - | Head/FMD (Chief Research Scientist) |
| 2. Dr. M. Ottah-Atikpo (Mrs.)      | - | Senior Research Scientist           |
| 3. Dr. M. Obodai (Mrs.)            | - | Senior Research Scientist           |
| 4. Dr. M. Owusu (Ms.)              | - | Research Scientist                  |
| 5. Peter Adoquaye Addo             | - | Research Scientist                  |
| 6. Bernice D. Kalton-Senaye (Mrs.) | - | Research Scientist                  |
| 7. Matilda Dzomeku (Mrs.)          | - | Research Scientist                  |
| 8. Ivy Yawson (Mrs.)               | - | Research Scientist                  |
| 9. Amy Atter (Mrs.)                | - | Asst. Res. Scientist                |
| 10. Deborah L. Narh (Ms.)          | - | Asst. Res. Scientist                |
| 11. Nina Bernice Ackah (Mrs.)      | - | Asst. Scientific Officer            |
| 12. Evans Agbemefle                | - | Asst. Scientific Officer            |
| 13. David K. Asiedu                | - | Prin. Technologist                  |
| 14. David K. Baisel                | - | Senior Technologist                 |
| 15. Richard Takli                  | - | Asst. Technologist                  |
| 16. Michael Amoo-Gyasi             | - | Senior Technologist                 |
| 17. Theophilus Annan               | - | Technologist                        |
| 18. Alexander Henry K. Appiah      | - | Technologist                        |

- 18. May A. Boham (Ms.) - Senior Tech. Officer
- 19. Angela Adams - Technologist

**Food Chemistry Division**

- 1. Dr. (Mrs.) K. Kpodo - Head/FCD (Prin. Research Scientist)
- 2. George A. Anyebuno - Research Scientist
- 3. Charles Diako - Research Scientist
- 4. Hayford Ofori - Research Scientist
- 5. Foster Y. Mensah - Asst. Research Scientist
- 6. William K. Amevor - Prin. Technologist
- 7. David N. A. Ankrah - Senior Technologist
- 8. Nelson Y. Amey - Senior Technologist
- 9. Mercy Fianu (Ms.) - Senior Technical Officer
- 10. Kofi K. Essel - Senior Technologist
- 11. Vincent Kyei Baffour - Technologist
- 12. Vida Awidi (Ms.) - Senior Technical Officer
- 13. Belinda Quaye (Mrs) - Technical Officer
- 14. Emefa Gblende (Ms.) - Technical Officer
- 15. Dorothy Narh (Mrs.) - Technical Officer
- 16. Ebenezer Tawiah - Technical Officer
- 17. Frank Dogbey - Technical Officer
- 18. Derrick Ashley - Technical Officer

**Food Nutrition & Socio-Economics Division**

- 1. Wilhemina Quaye (Mrs.) - Head/FNSEd (Snr. Research Scientist)
- 2. Mary Glover Amengor (Mrs.) - Senior Research Scientist
- 3. Lynda Hagan (Mrs.) - Research Scientist
- 4. Evelyn S. Buckman (Mrs.) - Assistant Research Scientist
- 5. Eric Owusu Sarpong - Research Scientist
- 6. Ruth Adesetu Pobee (Mrs.) - Research Scientist
- 7. Iris A. Tamakloe (Mrs.) - Chief Tech. Officer
- 8. Alice Padi (Mrs.) - Senior Technical Officer
- 9. Constance Boateng (Ms.) - Senior Technical Officer
- 10. Frank Mboom - Technologist

**APPENDIX II****CSIR-FRI Staff Promotions****(A) Senior Members**

<b>Name of Staff</b>	<b>Division</b>	<b>Promoted / Upgraded to</b>
Dr. Lawrence Abbey	FPED	Senior Research Scientist
Mr. Joseph Gayin	FPED	Senior Research Scientist
Ms. Janet Aggrey-Yawson	Admin	Administrative Officer
Mr. Raphael Kavi	CID	Librarian

**(B) Senior staff**

<b>Name of staff</b>	<b>Division</b>	<b>Promoted/Upgraded to</b>
Mr. Willaim Amevor	FCD	Chief Technologist
Mr. David Ankrah	FCD	Prin. Technologist
Mr. Nelson Amey	FCD	Prin. Technologist
Mr. Robert Lamptey	FPED	Chief Works Supt.
Mrs. Beulla Delle Sallah	Admin	Prin. Admin. Assistant
Mr. Jeremiah Lartey-Brown	CID	Prin. Tech. Officer
Ms. Mercy Esinam Fianu	FCD	Technologist
Ms. May Ama Boham-Dako	FMD	Technologist
Mrs. Helen Ama Annan	FPED	Technologist
Mrs. Belinda Quaye	FCD	Senior Tech. Officer
Mr. Derrick Ashley	FCD	Senior Tech. Officer
Mr. James Cromwell	Accounts	Senior Stores Supt
Ms. Mary Assimah	CID	Senior. Admin. Asst.
Mr. Desmond Mensah	FPED	Senior Tech. Officer

**(C) Junior Staff**

<b>Name of Staff</b>	<b>Promoted to</b>
Mr. Samuel Quaye	Senior Security Asst.
Mr. Emmanuel Agyei	Foreman
Mr. Sampson Tawiah	Foreman
Mr. Samuel Osarfo	Asst. Transport Officer
Paul Boadi	Supervisor Tradesman.
Abass Abdulai	Supervisor Gd. 1
Bob Atulibok	Supervisor Gd.1
Foster Akplaga	Technical Asst. Gd. 2
Frederick Martey	Supervisor Gd.1
Godson Agbeley	Technical Asst. Gd. 2
George Tetteh	Supervisor Gd.1
Moses Arthur	Supervisor Gd.1
Elizabeth Atta	Technical Asst. Gd. 2
Ernestina Armah	Technical Asst. Gd. 2
Gladys Seshie	Technical Asst. Gd. 2
John okine	Technical Asst. Gd. 2
Nuru Abdulai	Technical Asst. Gd. 2
Emmanuel Tetteh	Supervisor Gd.1
Ababase Akanzinam	Supervisor Gd.1
Daniel Asara	Supervisor Gd.1
Sunday Akantokdingin	Supervisor Gd.1
Solomon Godome	Technical Asst. Gd. 2



### APPENDIX III

#### CSIR-FRI Staff Who Completed Training

Name	Course Studied	Institution
Mr. Kwabena Asiedu Bugyei	MSc. MIS	KNUST
Mr. Kofi Kwegyir Essel	BSc. Applied Chemistry	UDS
Mrs. Helen Ama Annan	BSc. Laboratory Technology	UCC
Ms. May Ama Boham	BSc. Laboratory Technology	UCC

#### CSIR-FRI Staff under Training

NAME	PROGRAMME OF STUDY	INSTITUTION
Mr. Robert M. Yawson	PhD Science Technology & Environment	University of Minnesota, USA
Mrs. Charlotte Oduro-Yeboah	PhD Food Science	University of Ghana
Mrs. Bernice Karlton-Senaye	PhD Energy & Env. Systems	North Carolina State Univ. USA
Ms. Deborah L. Narh	MSc. Biotechnology	Wageningen University, The Netherlands
Mrs. Nina Bernice Ackah	MSc. Food Safety	Wageningen University, The Netherlands
Ms. Joana Dzikunu	Bachelor of Business Admin.	IPS
Ms. Justina Thompson	BSc Marketing	IPS
Mrs. Angela Addy	BSc Accounting	IPS
Mr. Emmanuel Allorsey	BSc. Food Sci & Tech	KNUST
Mr. Solomon Dowuona	BSc Lab. Tech.	University of Cape Coast
Mrs. Agatha Amuzu	BSc Agric.	University of Ghana
Mrs. Amy Atter	MSc Food Microbiology	KNUST
Mrs. Evelyn Serwah Buckman	MSc Food Sci. and Tech.	KNUST
Mr. Patrick Mintah Ofose	B-Tech. Mechanical	Ho Polytechnic
Ms. Constance Boateng	B-Tech . Hotel & Catering	Ho. Polytechnic

## APPENDIX IV

### Conferences, Courses, Workshops and Seminars Attended By CSIR-FRI Staff

Date of Conference/ Seminar	Type of Conference/Seminar	Organizers	Venue	Participants
11/01/11	Workshop on infant and young child Nutrition Bcc campaign strategy development.	Ghana Health Service	Miklin Hotel	Mrs. Ruth A. Pobee
17-19/01/11	Workshop on Gender mainstreaming	Gender & Energy Network	AngeHill Hotel, East Legon	Mrs. Mary Glover Amengor Mr. Peter Addo Mrs. Faustina Mante
1-2/02/11	19 <sup>th</sup> Session of the FAO/WHO Coordinating Committee for Africa.	FAO/WHO	Accra International Conference Center	Dr. Kafui Kpodo
3-4/02/11	PAN AFRICAN Meeting for Experts to discuss Codex issues in the Codex Committee on Contaminants in Foods (CCCF) of interest to Africa.	AU-IBAR	Namibia, Kenya	Dr. Kafui Kpodo
09/02/11	Workshop on Yams & Cassava investment	MITSUBISHI Research Institute	CSIR-STEPRI Accra	Dr. Charles Tortoe Mrs. Charlotte Oduro- Yeboah
20-26/2/11	Science writing, communication and presentation skills course	AWARD	Mombasa, Kenya	Mrs. Charlotte Oduro- Yeboah

12-16/03/11	Meeting on Gains from losses of Root and Tuber Crops.	Natural Resources Institute	U.K, Ghattham	Dr. Nanam T. Dziedzoave
21-25/03/11	5 <sup>th</sup> Session of the Codex Committee on Contaminants in Foods (CCCF)	FAO/WHO	The Hague, Netherlands	Dr. Kafui Kpodo
27/03/-2/04/11	C:AVA Annual Project Review meeting	Natural Resources Institute	U.K, Ghattham	Dr. Nanam T. Dziedzoave
15-18/03/11	National consultation on the draft text of the ECOWAS sub-regional framework for the assessment and risk management of biotechnology, taking into account the implications of the Nagoya-Kuala Lumpur supplementary protocol on liability and redress in the field of biotechnology.	ECOWAS	Accra, Erata Hotel	Dr. Mary Obodai
4-6/04/11	MYCORED (Mycotoxin Reduction ) Africa Conference	EU	Cape Town, South Africa	Dr. Kafui Kpodo
18-22/04/11	USAID Horticulture collaborative Research Support Programme, Spring 2011 conference.	USAID	USA, California	Dr. W. A. Plahar
3-6/05/11	African Food Traditions Revisited by Rearch (AFTER) Project Meeting.	AFTER	Mensvic Hotel	Mr. Hayford Ofori

12/05/11	First mushroom industry stakeholders meeting.	Mushroom growers & exporters association of Ghana	Accra, Erata Hotel	Ms. Matilda Dzomeku
16-25/05/11	Mentoring Program for Government officials involved in the work of codex alimentarius	FAO/WHO		Dr. P.N-T. Johnson
6-24/06/11	Conference on monitoring evaluation and impact assessment of food and nutrition security programmes	Wageningen Center for Development Innovation	Netherlands	Mrs. Lynda Hagan
14-23/06/11	74 <sup>th</sup> Meeting of the joint FAO/WHO Expert Committee dedicated to the evaluation of certain contaminants in foods.	FAO/WHO	Rome, Italy	Dr. Kafui Kpodo
15-24/06/11	First West-African mycological training course	Lab. Of systematic mycology, LMU Munchen Germany & Department of Botany & Plant ecology, University of Lome	Togo, Lome	Ms. Matilda Dzomeku
30/06/11	Meeting on National Platform for disaster risk reduction and climate change risk management	NADMO	Ghana Trade fair company conference hall	Dr. K.A. Vowotor



6-8/07/11	Stakeholders meeting towards the implementation on the international conference & exhibition on food processing	Ridmut Consult	Ministry of Trade	Dr. Charles Tortoe
14/07/11	African women in agricultural research and development (AWARD) fellows mentee mentoring orientation workshop.	AWARD	Kenya, Nairobi	Ms. Matilda Dzomeku
23-29/07/11	Research Proposal Writing course		Kenya, Mombasa	Dr. Mary Obodai
8-9/08/11	Workshop on Agriculture policies in Ghana.	WAAPP	CSIR-SRI, Kumasi	Dr. Margaret Owusu Mr. Hayford Ofori
16/08/11	Inception workshop on “Enhancing Food Security in Africa through the Improvement of Rice post-harvest handling and the Development of new rice-based products”.	AfricaRice	Mensvic Hoetl, Accra	Mr. Charles Diako Mr. Hayford Ofori
24-25/08/11	SABIMA Biotechnology Stewardship Training Workshop	CSIR-STEPRI	Accra	Dr. Mary Obodai
26/8-01/10/11	Workshop on planning, implementation and monitoring of National Rice Development Strategy (NRDS) for Sub-Saharan African Countries	Japan International Cooperation Agency (JICA)	Japan	Mr. Joseph Gayin
12-18/09/11	AWARDS Women’s leadership and Management Course	AWARD	Tanzania, Arusha	Dr. Mary Obodai

15-16/09/11	Workshop on Gender and Climate change conference	African Women in Agricultural Research & Development	Italy, Prato	Mrs. Wilhemina Quaye
19/09/11-05/01/12	Norman E. Borlay International Agricultural Science & Technology Fellowship Programme	USDA	USA, Florida	Mrs. Lynda Hagan
21-27/09/11	Women's Leadership & Management course	AWARD	Tanzania, Arusha	Mrs. C. Oduro-Yeboah
22/09-01/12/11 and 24/09-18/11/11	Norman E. Borlay International Agricultural Science & Technology Fellowship Programme	United States Department of Agric. (USDA)	USA, Washington State	Mr. Charles Diako
28-29/09/2011	Stakeholders workshop on Disaster Risk Reduction (DRR) Climate Change Adaption (CCA)	NADMO	Accra	Dr. K.A Vowotor
3-5/10/11	AFTER Project Value Chain Analysis Training Workshop.	AFTER	Mensvic Hotel, Accra	Dr. Margaret Owusu Mr. Hayford Ofori
10-12/10/11	Workshop for Research Institutions on access and use of patent information	World Intellectual Property Organization & Registrar General's Department	GIMPA, Accra	Dr. Charles Tortoe Mr. Raphael Kavi
10-13/10/11	10 <sup>th</sup> African Crop Science Society meeting	African Crop Science Society	Mozambique, Maputo	Mrs. Charlotte Oduro-Yeboah
17-21/10/11	Award mentoring orientation workshop	AWARD	Kenya, Nairobi	Mrs. Wilhemina Quaye

23-28/10/11	International workshop on the embedment of agricultural research into food sovereignty approach	Telfun/ Wageningen University	Benin, Cotonou	Mrs. Wilhemina Quaye
24/10/-20/12/11	Optimization de la Production de farmes de plantain et de manioc pour la formulation d'aliments textures de type, fufu	CI RAD	France	Mrs. C. Oduro-Yeboah
01-03/11/11	TEEAL, AGORA, HINARI, OARE and PROTA Training-of-Trainer Workshop.	CSIR-INSTI & ITOCA, South Africa	Accra, CSIR-INSTI	Mr. Raphael Kavi; Mr. Kwabena Bugyei; Ms. Mariam Yakubu
22-25/11/11	Launching workshop on rice agronomy and rice processing and value addition task forces	AfricaRice Center	Benin, Cotonou	Dr. P.N -T Johnson
22-25/11/12	Workshop on fish Technology, Utilization & Quality Assurance in Africa.	UN/FAO	Seychelles	Dr. M. Ottah Atikpo
29/11-9/12/11	Workshop on Procedures for sensory evaluation and consumer preference studies involving the African consumer.	AFTER	CSIR-FRI, Accra	Dr. Margaret Owusu Mr. George Anyebuno Mr. Charles Diak Mr. Hayford Ofori
15-16/12/11	Corporate Women's Conference		Maple Leaf Hotel, Accra	Dr. Kafui. Kpodo

## APPENDIX V

### Scientific Reports and Publications

#### *Edited Research Reports*

- 1) **Obodai, M., Dzomeku, M.,** Pappoe, J., Gidisu, C., Atopla, R. and **Takli, R. (2011)**. Cultivation of the oyster mushroom (*Pleurotus ostreatus*) on cellulosic residues from rice straw.
- 2) **Obodai, M., Apertorgbor, M., Dzomeku, M. and Apertorgbor, A. (2011)**. Biodiversity, Ecology and Uses of larger fungi (*Macromycetes, Basidiomycota, Fungi*) in West Africa.
- 3) **Ottah Atikpo, M.A, Asiedu, D.K and Baisel, D.K (2011)**. Evaluation of disinfectant for microbial decontamination of the microbiology laboratory floor by an in-use test.
- 4) **Obodai, M., Dzomeku, M. and Narh, D (2011)**. Growth and yield performance of different exotic strains of eight *Pleurotus* species cultivated on *Triplochiton scleroxylon* in Ghana.
- 5) **Obodai, M. and Odamtten, G.T (2011)**. Phenology of mycoflora and some physical and organic composition of agricultural waste used in the cultivation of the mushroom *Volvariella volvacea*.
- 6) **Obodai, M., Dzomeku, M. and Apertorgbor, M. (2011)**. Edible and medicinal mushrooms as functional foods in Ghana
- 7) **Tortoe, C., Johnson, P-N. T., Meidema, M., Oduro-Yeboah, C., Addo, P., Tamakloe, I. and Nyarko, A., (2011)**. Standardization of pineapple flour and syrup for the confectionary industries. CSIR-FRI/TNO Project, Accra, Ghana. pp. 27.
- 8) **Tortoe, C., Nyarko, A., Mireku, E. and Ofori, J. (2011)**. Report on Flavored Drink Production Techniques Training Workshop for Small Scale Industries. CSIR-FRI, Accra, Ghana. pp.16.
- 9) **Tortoe, C., Nyarko, A., Mireku, E. and Ofori, J. (2011)**. Training Workshop Report on Fruit Juice Production Techniques for Small Scale Industries. CSIR-FRI, Accra, Ghana. pp.20.
- 10) **Tortoe, C., Nyarko, A., Mireku, E. and Ofori, J. (2011)**. Training Workshop Report on Delicious Honey Shake Drink for Small Scale Industries. 8<sup>th</sup> June – 10<sup>th</sup> June, 2011. CSIR-FRI, Accra, Ghana. pp.19.



- 11) **Tortoe, C., Nyarko, A., Mireku, E. and Saka, E. (2011).** Report on a Training Workshop on Tiger nut plus Coconut Drink for an Industrialist. CSIR-FRI, Accra, Ghana. pp.21.
- 12) **Tortoe, C. and Nyarko, A. (2011).** Report on a Training Workshop on Noni Juice and Noni Powder for an Industrialist. CSIR-FRI, Accra, Ghana. pp.19.
- 13) **Quaye, W., Gayin, J. and Baidoo, E. (2011).** Technical assessment of rice production and post harvest practices. Baseline and needs assessment in Upper West Region.
- 14) **Gayin, J., Baidoo, E., Quaye, W. and Peget, M.F. (2011).** Technical assessment of rice production and post harvest practices. Report on baseline survey and needs assessment of farmers and processors in the Northern Region of Ghana.
- 15) **Ottah Atikpo, M. (2011).** Training and training-related activities for Tinin Kanya Women Group Farmer Based Organization at Kpasenkpe in West Mamprusi District of the Northern Region.
- 16) **Komlaga, G.A and Glover-Amengor, M. (2011).** Annual technical report on CSIR-FRI/C:AVA Project activities for the period April 2011 through August 2011.

### *Journal Papers*

- 1) **Yawson, R. M. (2011).** Africa's Nanofuture: The Importance of Regionalism. International Journal of Nanotechnology, 8.
- 2) **Yawson, R. M. (2011).** Historical Antecedents as Precedents for Nanotechnology Vocational Education Training and Workforce Development. Human Resource Development Review, 10.
- 3) **Yawson, R. M. (2011).** Organizational Change: Themes and Issues (Book Review). Human Resource Development International, 14(3).
- 4) **Owusu, M., Peterson, A.M., Heimdal, H. (2011).** Relationship of sensory and instrumental aroma measurements of dark chocolate as influenced by fermentation method, roasting and conching conditions. Journal of Food Science and Technology.
- 5) **Owusu, M., Peterson, A.M., Heimdal, H (2011).** Effect of fermentation method, roasting and conching conditions on the aroma volatiles of dark chocolate. Journal of Food Processing and Preservation.
- 6) **Narh, D. L., Obodai, M., Baka, D. and Dzomeku, M. (2011)** The Efficacy of Sorghum and Millet Grains in Spawn Production and Carpophore Formation of

- Pleurotus ostreatus (Jacq. Ex. Fr) Kummer (International Food Research Journal 18(3): 1092-1097)
- 7) Frimpong–Manso, J., **Obodai, M., Dzomeku, M. & Apertorgbor, M. M. (2011)** Influence of rice husk on biological efficiency and nutrient content of Pleurotus ostreatus (Jacq. ex. Fr.) Kummer. (International Food Research Journal 18: 249-254.
  - 8) Aidoo, H., Sakyi-Dawson, E., **Abbey, L.**, Tano-Debrah, K., Saalia, K.F. (2011) Optimization of chocolate formulation using dehydrated peanut-cowpea milk to replace dairy milk. Journal for Science Food Agric, DOI 10.1002/jsfa.4563
  - 9) **Tortoe, C.**, Orchard, J., Beezer, A. and Tetteh, J., (2011). Application of radial basis function network with a Gaussian Function of Artificial Neural Networks in osmo-dehydration of plant materials. Journal of Artificial Intelligence 4, 233-244.
  - 10) **Oduro-Yeboah, C.**, Onwulata, C., **Tortoe, C.**, and Thomas-Gahring, A. (2011). Functional properties of plantain and cowpea flours in extruded products. Journal of Food Processing and Preservation (In press)
  - 11) **Tortoe, C.**, Orchard, J. and Beezer, A. (2011). Multilinear regression approach in predicting osmo-dehydration processes in three plant materials'. Journal of Food Processing and Technology 2 (5): 122. DOI: 10.4172/2157-7110.1000122.
  - 12) **Tortoe, C., Johnson, P-N. T., Slaghek, T., Oduro-Yeboah, C., Addo, P., Tamakloe, I. and Nyarko, A., (2011).** Physicochemical, proximate and sensory properties of organic side-stream pineapple (Ananas sp.) flour. Journal of Food Science and Technology (in press).
  - 13) **Tettey, E.C-T. (2011).** Improving snail meat processing in Ghana. Ghana Journal of Agric. Sci. 44.
  - 14) **Tettey, E.C-T., Osei-Yaw, A. and Hodare-Okae, M. (2011).** The quality of traditionally cooked cow hide a source of food in Ghana Journal Agric. Sci. (2011), 44.
  - 15) **Ottah Atikpo, M.A., Asiedu, D.K. and Baisel, D.K. (2011).** Evaluation of disinfectant for microbial decontamination of the microbiology laboratory floor by an in-use test. Journal of Research in Antimicrobials 1: 013 – 022.
  - 16) **Ottah Atikpo, M.A, Asiedu, D.K. and Baisel, D.K. (2011).** Monitoring of microbiology laboratory working environment. Journal of Research in Microbes 1: 011 – 022.
  - 17) **Quaye, W., Buckman A.K., Frempong E.S., Jongerden .G., J. and Ruivenkamp, G. (2011).** A Socioeconomic Assessment of cowpea diversity on the Ghanaian Market: Implications for breeding. International Journal of Consumer Studies 35:679-687

- 18) **Diako C., Manful J. T., Johnson P. N. T., Sakyi-Dawson E., Bediako-Amoa B., and Salia F. K. (2011).** Physicochemical characterization of four commercial rice varieties in Ghana. *Advance Journal of Food Science and Technology* 3(3): 196-202.
- 19) Parkouda, C., Diawara, B., Lowor, S., **Diako, C., Saalia, F. K., Annan, N. T., Jensen, J. S. Tano-Debrah, K. and Jakobsen, M. (2011).** Volatile compounds of Maari, a fermented product from Baobab (*Adanconia digitata* L.) seeds. *African Journal of Biotechnology* 10(20): 4197-4206.
- 20) Houssou, P. A., **Kpodo, K. A., Fandohan, P., Ahohuendo, B. C. and Hounhouigan, D. J. (2011).** Susceptibility of steeped and heat dried cowpea flour to fungal growth and aflatoxins production. *African Journal of Food Science* 5 (4): 227-231.

### *Conference papers*

- 1) **Tortoe, C and Johnson, P-N. T., (2011).** Current state of policies and strategies for the processing of agricultural products in Ghana. A paper presented at the Regional Workshop on Policies and Strategies for Food Processing of Agricultural Products in West and Central Africa, 11<sup>th</sup> -13<sup>th</sup> July, 2011, Saly Portudal, Senegal.
- 2) **Tortoe, C and Johnson, P-N. T., (2011).** Current state of policies and strategies for the processing of agricultural products in Ghana. A paper presented at the Regional Workshop on Policies and Strategies for Food Processing of Agricultural Products in West and Central Africa, 11<sup>th</sup> -13<sup>th</sup> July, 2011, Saly Portudal, Senegal.
- 3) **Ottah Atikpo, M.A., Abbey, L.D., Glover-Amengor, M., Lawer, L., Ayin, J. and Toppe, J. (2011).** Micronutrient enrichment of meals fed to Pupils using highly nutritious and low-cost underutilized fish under the School feeding Programme in Ghana. Presented to FAO in Seychelles meeting.

### *Conference Posters*

- 1) **Tortoe, C., Johnson, P-N.T, Abbey, L., Baidoo, E., Anang, D., Graham, S. and Saka, E. (2011).** Sensory properties of pre-treated blast-chilled yam (*Dioscorea rotundata*) chips as a convenient food product. Poster presented at the West Africa Root and Tuber Crops Conference, 12<sup>th</sup> -16<sup>th</sup> September, 2011, Mensvic Grand Hotel, East Legon, Accra.
- 2) **Oduro-Yeboah, C., Onwulata, C., Tortoe, C., and Thomas-Gahring, A. (2011).** Studies on functionality of plantain-cowpea blends for extruded products. Poster



presented at the 10<sup>th</sup> Africa Crop Science Society Conference, 10-13<sup>th</sup> October, Maputo, Mozambique.

### *Consultancy Reports*

- 1) **Oduro .H, Sampare .S.A, Gayin .J, Anaman .E, Johnson P-N.T and Dakura .P. (2011).** Report on workshops to introduce fortification of cereal flour with micronutrients in twelve communities in the three Northern regions of Ghana. CSIR-FRI/WFP scale up 2 of community-based milling and fortification in Northern Ghana project.
- 2) **Dziedzoave, N. T., (2011).** Cassava: Lessons from a Decade of Investments – Ghana Case Study. Consultancy Report presented to the Food and Agricultural Organisation of the United Nations. 95pp.

### *Media Publications*

- 1) **Vowotor, K.A, Nketia, S., Yakubu, M. and Andoh, A. (2011).** Roots and tuber crops for industrial development. Of West Africa. Daily Graphic, Friday, October 14, 2011.
- 2) **Pobee, R.A. (2011).** Eating a rainbow. Daily Graphic. Saturday, November 26, 2011.
- 3) **Pobee, R.A. (2011).** Eating well at Christmas. Daily Graphic. Friday, December 23, 2011. p. 10

### *Memoirs*

- 1) **Obodai, M., Dzomeku, M., Takli, R.K. (2011).** Introduction to edible and medicinal mushrooms.
- 2) **Dzomeku, M., Obodai, M and Takli, R.K (2011)** Steps in oil palm mushroom cultivation in Ghana

### *Book*

- 1) **Ottah A.M. (2011).** Agriculture for Improved Nutrition of Women and Children in Nigeria after presentation to the Nigerian Academy of Science in Abuja, Nigeria. African Book Publishers Ltd, Lagos Nigeria. ISBN:978-978-153-3990-0.
- 2) **A.S. Bulder, M. DiNovi, K.A. Kpodo, J.-C. Leblanc, S. Resnik, G.S. Shephard, W. Slob, R. Walker and G. Wolterink (2011).** “Deoxynivalenol (DON)”. In: WHO



Technical Report Series No. 959, "Evaluation of certain contaminants in foods". Seventy-second report of the Joint FAO/WHO Expert Committee on Food Additives. WHO and FAO (Eds.), pp. 37-48. ISBN-978-92-4-120959-5; ISSN-0512-3054.

- 3) A.S. Bulder, M. DiNovi, **K.A. Kpodo**, J.-C. Leblanc, S. Resnik, G.S. Shephard, W. Slob, R. Walker and G. Wolterink (2011). "Deoxynivalenol (Addendum)". In: WHO Food Additives Series No. 63 / FAO JECFA Monographs No. 8 "Safety evaluation of certain contaminants in foods". Prepared by the Seventy-second meeting of the Joint FAO/WHO Expert Committee on Food Additives. WHO and FAO (Eds.), WHO Press, Geneva, pp. 317-485. ISBN-978-92-4-166063-1 WHO; ISBN-978-92-5-106736-9 FAO; ISSN-0300-0923.

## APPENDIX VI

## IGF Report for the year ending 31st Dec., 2011

	<u>PERIODS (QUARTERS)</u>	<u>1ST</u>	<u>2ND</u>	<u>3RD</u>	<u>4TH</u>	<u>TOTAL</u>
<b>UNITS</b>						
<b>INDUSTRIAL SERVICES UNIT(MICROBIOLOGY)</b>	INCOME	32,910.60	66,750.50	90,027.00	86,435.20	276,123.30
	CHEMICAL COST	(6,189.48)	(33,157.70)	(15,536.67)	(12,373.73)	(67,257.58)
	OTHER EXPENSES	(3,543.81)	-	-	(10,991.40)	(14,535.21)
	DEP. FIXED ASSETS	(3,291.06)	(6,675.05)	(9,002.70)	(8,643.52)	(27,612.33)
	<b>GROSS MARGIN</b>	<b>19,886.25</b>	<b>26,917.75</b>	<b>65,487.63</b>	<b>54,426.55</b>	<b>166,718.18</b>
<b>MUSHROOM</b>	INCOME	4,876.10	4,539.00	4,803.00	3,203.50	17,421.60
	DEP. FIXED ASSETS	(487.61)	(453.90)	(480.30)	(320.35)	(1,742.16)
	CHEM/OTHER. COST	(1,840.43)	(8,817.98)	(773.00)	(3,478.96)	(14,910.37)
	<b>GROSS MARGIN</b>	<b>2,548.06</b>	<b>(4,732.88)</b>	<b>3,549.70</b>	<b>(595.81)</b>	<b>1,364.88</b>
<b>CHEMISTRY</b>	INCOME	12,626.50	8,509.00	12,090.00	15,206.85	48,432.35
	CHEMICAL COST	-	(19,504.49)	(4,946.35)	(9,373.65)	(33,824.49)
	OTHER EXP	(8,236.65)	-	-	(3,722.22)	(11,958.87)
	DEP. FIXED ASSETS	(1,262.65)	(850.90)	(1,209.00)	(1,520.69)	(4,843.24)
	<b>GROSS MARGIN</b>	<b>3,127.20</b>	<b>(11,846.39)</b>	<b>5,934.65</b>	<b>590.30</b>	<b>(2,784.54)</b>
	INCOME	5,916.00	2,700.00	8,938.00	14,211.56	31,765.56

<b>MYCOTOXIN</b>	INCOME	5,916.00	2,700.00	8,938.00	14,211.56	31,765.56
	CHEMICAL COST	-	-	-	-	-
	DEP. FIXED ASSETS	(591.60)	(270.00)	(893.80)	(1,421.16)	(3,176.56)
	OTHER EXPENSES	=	=	=	=	=
	<b>GROSS MARGIN</b>	<b>5,324.40</b>	<b>2,430.00</b>	<b>8,044.20</b>	<b>12,790.40</b>	<b>28,589.00</b>
<b>ENGINEERING</b>	INCOME	200.00	-	-	-	200.00
	DEP. FIXED ASSETS	(20.00)	-	-	-	(20.00)
	OPERATIONAL COST	(300.00)	=	=	=	(300.00)
	<b>GROSS MARGIN</b>	<b>(120.00)</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>(120.00)</b>
<b>PROCESSING</b>	INCOME	4,803.90	9,235.80	14,562.00	14,738.20	43,339.90
	TRG INCOME	-	-	-	2,070.00	2,070.00
	COST MATERIALS	(2,405.00)	(7,957.64)	(705.00)	(6,370.00)	(17,437.64)
	OTHER EXPENSES	(1,858.00)	(1,733.00)	(1,776.00)	(1,993.50)	(7,360.50)
	DEP. FIXED ASSETS	(480.39)	(923.58)	(1,456.20)	(1,680.82)	(4,540.99)
	<b>GROSS MARGIN</b>	<b>60.51</b>	<b>(1,378.42)</b>	<b>10,624.80</b>	<b>6,763.88</b>	<b>16,070.77</b>
	INCOME	803.00	1,608.00	2,054.00	3,469.00	7,934.00
	TRG INCOME	-	-	-		

<b>RTPDU</b>	INCOME	803.00	1,608.00	2,054.00	3,469.00	7,934.00
	TRG INCOME	-	-	-	1,629.00	1,629.00
	DEP. FIXED ASSETS	(80.30)	(160.80)	(205.40)	(509.80)	(956.30)
	COST OF MATERIAL	(4,090.00)	(1,430.00)	(2,440.00)	(1,420.00)	(9,380.00)
	<b>GROSS MARGIN</b>	<b>(3,367.30)</b>	<b>17.20</b>	<b>(591.40)</b>	<b>3,168.20</b>	<b>(773.30)</b>
<b>CID/LIBRARY</b>	INCOME	435.15	1,016.20	721.50	267.00	2,439.85
	DEP. FIXED ASSETS	(43.52)	(101.62)	(72.15)	(26.70)	(243.99)
	OUTFLOW	=	(5,742.56)	=	=	(5,742.56)
	<b>GROSS MARGIN</b>	<b>391.64</b>	<b>(4,827.98)</b>	<b>649.35</b>	<b>240.30</b>	<b>(3,546.70)</b>
<b>UNITS</b>						
<b>FNSD</b>	INCOME	25.00	-	881.00	420.00	1,326.00
	DEP. FIXED ASSETS	(2.50)	-	(88.10)	(42.00)	(132.60)
	OUTFLOW	(200.00)	=	(547.80)	=	(747.80)
	<b>GROSS MARGIN</b>	<b>(177.50)</b>	<b>-</b>	<b>245.10</b>	<b>378.00</b>	<b>445.60</b>
<b>MIDA/OTHERS</b>	INCOME	5,000.00	-	-	-	5,000.00
<b>HIRING OF CONFERENCE ROOM</b>	CASH INFLOW	280.00	-	-	454.00	734.00
	DEP. FIXED ASSETS	(528.00)	=	=	(45.40)	(573.40)
		<b>4,752.00</b>	-	-	<b>408.60</b>	5,160.60
<b>TRAINING</b>	INCOME	1,400.00	-	3,850.00	5,320.00	10,570.00
	DEP. FIXED ASSETS	(140.00)	-	(385.00)	(532.00)	(1,057.00)
	HONO. TRAINING/COST	(554.00)	-	-	-	(554.00)
	OUTFLOW	(2,003.00)	=	=	(2,388.24)	(4,391.24)
	<b>GROSS MARGIN</b>	<b>(1,297.00)</b>	<b>-</b>	<b>3,465.00</b>	<b>2,399.76</b>	<b>4,567.76</b>



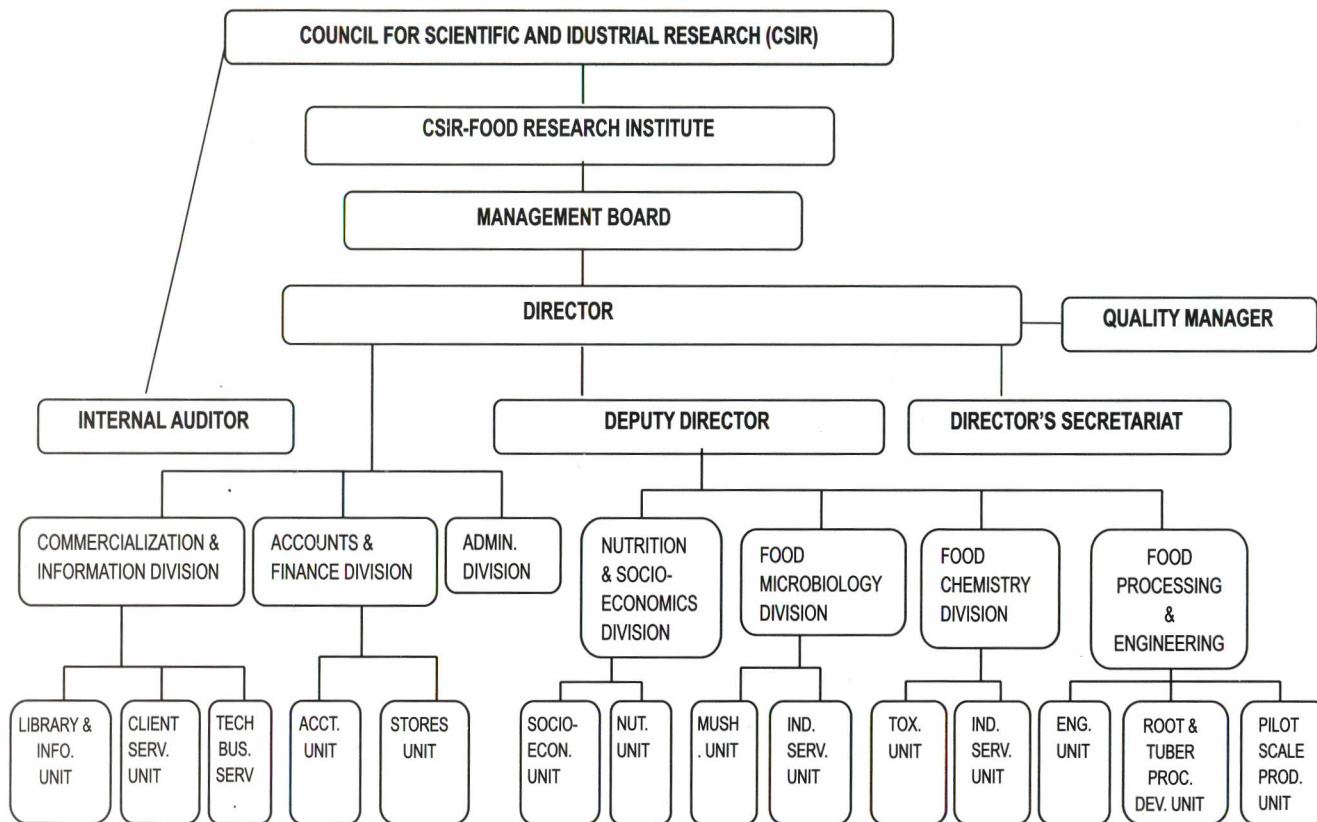
## APPENDIX VI

## IGF Report for the year ending 31st Dec., 2011

	PERIODS (QUARTERS)	1ST	2ND	3RD	4TH	TOTAL
UNITS						
INDUSTRIAL SERVICES UNIT(MICROBIOLOGY)	INCOME	32,910.60	66,750.50	90,027.00	86,435.20	276,123.30
	CHEMICAL COST	(6,189.48)	(33,157.70)	(15,536.67)	(12,373.73)	(67,257.58)
	OTHER EXPENSES	(3,543.81)	-	-	(10,991.40)	(14,535.21)
	DEP. FIXED ASSETS	(3,291.06)	(6,675.05)	(9,002.70)	(8,643.52)	(27,612.33)
	<b>GROSS MARGIN</b>	<b>19,886.25</b>	<b>26,917.75</b>	<b>65,487.63</b>	<b>54,426.55</b>	<b>166,718.18</b>
MUSHROOM	INCOME	4,876.10	4,539.00	4,803.00	3,203.50	17,421.60
	DEP. FIXED ASSETS	(487.61)	(453.90)	(480.30)	(320.35)	(1,742.16)
	CHEM/OTHER. COST	(1,840.43)	(8,817.98)	(773.00)	(3,478.96)	(14,910.37)
	<b>GROSS MARGIN</b>	<b>2,548.06</b>	<b>(4,732.88)</b>	<b>3,549.70</b>	<b>(595.81)</b>	<b>1,364.88</b>
	CHEMISTRY	INCOME	12,626.50	8,509.00	12,090.00	15,206.85
CHEMICAL COST		-	(19,504.49)	(4,946.35)	(9,373.65)	(33,824.49)
OTHER EXP		(8,236.65)	-	-	(3,722.22)	(11,958.87)
DEP. FIXED ASSETS		(1,262.65)	(850.90)	(1,209.00)	(1,520.69)	(4,843.24)
<b>GROSS MARGIN</b>		<b>3,127.20</b>	<b>(11,846.39)</b>	<b>5,934.65</b>	<b>590.30</b>	<b>(2,784.54)</b>
MYCOTOXIN	INCOME	5,916.00	2,700.00	8,938.00	14,211.56	31,765.56
	CHEMICAL COST	-	-	-	-	-
	DEP. FIXED ASSETS	(591.60)	(270.00)	(893.80)	(1,421.16)	(3,176.56)
	OTHER EXPENSES	=	=	=	=	=
	<b>GROSS MARGIN</b>	<b>5,324.40</b>	<b>2,430.00</b>	<b>8,044.20</b>	<b>12,790.40</b>	<b>28,589.00</b>
ENGINEERING	INCOME	200.00	-	-	-	200.00
	DEP. FIXED ASSETS	(20.00)	-	-	-	(20.00)
	OPERATIONAL COST	(300.00)	=	=	=	(300.00)
	<b>GROSS MARGIN</b>	<b>(120.00)</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>(120.00)</b>
	PROCESSING	INCOME	4,803.90	9,235.80	14,562.00	14,738.20
TRG INCOME		-	-	-	2,070.00	2,070.00
COST MATERIALS		(2,405.00)	(7,957.64)	(705.00)	(6,370.00)	(17,437.64)
OTHER EXPENSES		(1,858.00)	(1,733.00)	(1,776.00)	(1,993.50)	(7,360.50)
DEP. FIXED ASSETS		(480.39)	(923.58)	(1,456.20)	(1,680.82)	(4,540.99)
<b>GROSS MARGIN</b>		<b>60.51</b>	<b>(1,378.42)</b>	<b>10,624.80</b>	<b>6,763.88</b>	<b>16,070.77</b>

<b>RTPDU</b>	<b>INCOME</b>	803.00	1,608.00	2,054.00	3,469.00	7,934.00
	<b>TRG INCOME</b>	-	-	-	1,629.00	1,629.00
	<b>DEP. FIXED ASSETS</b>	(80.30)	(160.80)	(205.40)	(509.80)	(956.30)
	<b>COST OF MATERIAL</b>	(4,090.00)	(1,430.00)	(2,440.00)	(1,420.00)	(9,380.00)
	<b>GROSS MARGIN</b>	<b>(3,367.30)</b>	<b>17.20</b>	<b>(591.40)</b>	<b>3,168.20</b>	<b>(773.30)</b>
<b>CID/LIBRARY</b>	<b>INCOME</b>	435.15	1,016.20	721.50	267.00	2,439.85
	<b>DEP. FIXED ASSETS</b>	(43.52)	(101.62)	(72.15)	(26.70)	(243.99)
	<b>OUTFLOW</b>	=	(5,742.56)	=	=	(5,742.56)
	<b>GROSS MARGIN</b>	<b>391.64</b>	<b>(4,827.98)</b>	<b>649.35</b>	<b>240.30</b>	<b>(3,546.70)</b>
<b>UNITS</b>						
<b>FNSD</b>	<b>INCOME</b>	25.00	-	881.00	420.00	1,326.00
	<b>DEP. FIXED ASSETS</b>	(2.50)	-	(88.10)	(42.00)	(132.60)
	<b>OUTFLOW</b>	(200.00)	=	(547.80)	=	(747.80)
	<b>GROSS MARGIN</b>	<b>(177.50)</b>	-	<b>245.10</b>	<b>378.00</b>	<b>445.60</b>
<b>MIDA/OTHERS</b>	<b>INCOME</b>	5,000.00	-	-	-	5,000.00
<b>HIRING OF CONFERENCE ROOM</b>	<b>CASH INFLOW</b>	280.00	-	-	454.00	734.00
	<b>DEP. FIXED ASSETS</b>	(528.00)	=	=	(45.40)	(573.40)
		<b>4,752.00</b>	-	-	<b>408.60</b>	5,160.60
<b>TRAINING</b>	<b>INCOME</b>	1,400.00		3,850.00	5,320.00	10,570.00
	<b>DEP. FIXED ASSETS</b>	(140.00)	-	(385.00)	(532.00)	(1,057.00)
	<b>HONO. TRAINING/COST</b>	(554.00)	-	-	-	(554.00)
	<b>OUTFLOW</b>	(2,003.00)	=	=	(2,388.24)	(4,391.24)
	<b>GROSS MARGIN</b>	<b>(1,297.00)</b>	-	<b>3,465.00</b>	<b>2,399.76</b>	4,567.76

## APPENDIX VII ORGANOGRAM OF CSIR- FRI



**ACCT.-** ACCOUNTS    **ADMIN.-** ADMINISTRATION    **BUS.-** BUSINESS    **DEV.-** DEVELOPMENT    **ECON.-** ECONOMICS    **ENG.-** ENGINEERING  
**IND.-** INDUSTRIAL    **INFO.-** INFORMATION    **MUSH-** MUSHROOM    **NUT.-** NUTRITION    **PROC.-** PROCESSING  
**PROD.-** PRODUCTION    **SERV.-** SERVICE    **TOX.-** TOXICOLOGY    **TECH.-** TECHNOLOGY

