# COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

# PLANT GENETIC RESOURCES RESEARCH INSTITUTE

# ANNUAL REPORT

# 2015

**1.0 EXECUTIVE SUMMARY**

The Plant Genetic Resources Research Institute (PGRRI) is one of the 13 research institutes under the Council for Scientific and Industrial Research (CSIR). The CSIR-PGRRI has the mandate to collect, characterize, evaluate, document, conserve, distribute and utilize plant genetic resources (PGR) from Ghana and abroad. The PGR are fundamental to plant improvement but are threatened through the activities of man and natural hazards. The activities at PGRRI are administered by the Director and assisted by 6 Divisional Heads. The divisions are: Plant Genetic Diversity, Plant Genetic Conservation, Plant Protection Division, Finance, Administration and Commercialization and Information. The research programmes involve: surveys, collection, characterization, evaluation, documentation, conservation, regeneration, distribution and utilization of legumes, cereals, vegetables, root and tuber crops, medicinal plants, fruit trees, spices and forest species. The commercialization activities involve the production and sale of planting materials (seedlings), farm produce, rendering of consultancy services, eco-tourism and training. The Institute has linkages with international organizations in PGR conservation, CSIR institutes, the Universities and Non-Governmental Organizations.

### 1.1 Mandate

The mandate of the PGRRI is to collect and conserve PGR of Ghana as well as co-ordinate PGR activities in Ghana.

### 1.2 Vision

The vision of CSIR-PGRRI is to become a Centre of Excellence in sustainable plant genetic resources conservation and utilization for wealth creation.

### 1.3 Mission

The CSIR-PGRRI has the mission to collect and conserve PGR of Ghana and from abroad to prevent their extinction.

### 1.4 Goal

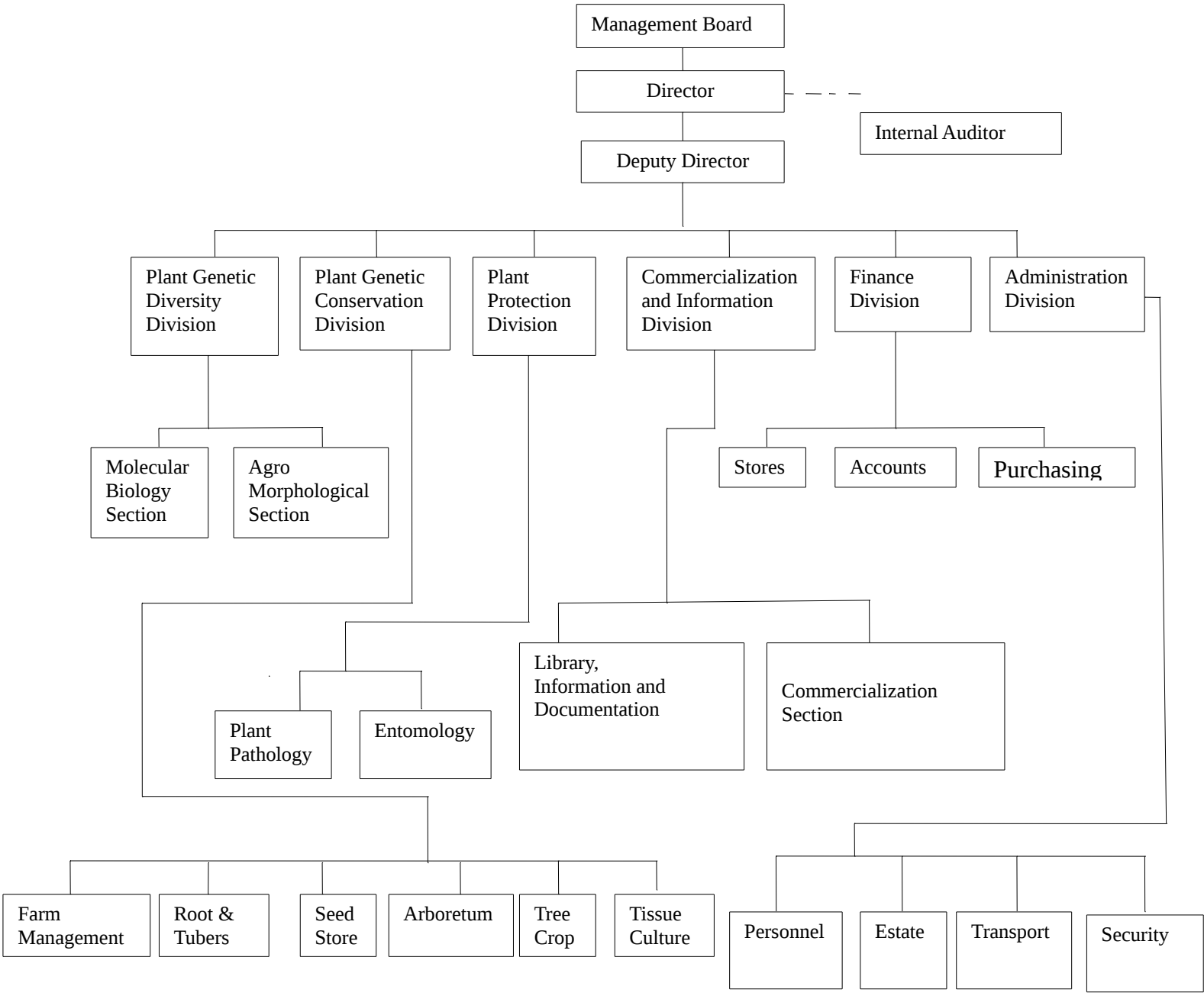
The goal of the CSIR-PGRRI is to ensure effective conservation and use of PGR for food security and sustainable agricultural development.

### 1.5 OBJECTIVES

**The objectives of CSIR-PGRRI are as follows;**

- To develop technologies for the efficient conservation and utilization of orthodox and recalcitrant PGR materials;
- To strengthen human resource capacity and capability;
- To identify, establish and strengthen inter institutional collaboration and linkages;
- To identify and access external donor funding and commercialized research results and;
- To gather, process and disseminate information relevant to PGR management in Ghana.

## 1.6 Organisational chart of CSIR-PGRRI



## 2.0 Plant Genetic Diversity Division

**2.1Project Title:**Development of large cream seeded cowpea varieties for the coastal savannah of Ghana

**Principal Investigator:** K. F. Egbadzor

**Project Team:** D. Ashi eKotey, D. K. Gamedoagbao, M. Yeboah, K. Ofori, B. Kemetse.

**Objective**: To evaluate nine improved varieties of cowpea in the coastal savannah belt of Ghana to select the best performers for seed multiplication.

**Results**

**Table 1:** Grain weight and yield of the cowpea lines and estimated yield per hectare

| **Cowpea line** | **Yield per plot (kg)** | **Estimated yield (kg) per hectare** | **1000 seed weight (g)** |
|---|---|---|---|
| CBGh3710 – 1 | 1.270 | 1411.11 | 152.9 |
| CBGh3710 – 2 | 1.185 | 1316.67 | 144.6 |
| Videza | 1.280 | 1422.22 | 137.9 |
| Ayiyi | 1.496 | 1662.22 | 118.0 |
| UCR779/CB27 – 4 | 0.855 | 950.00 | 216.7 |
| California Blackeye | 1.211 | 1345.56 | 181.3 |
| IT99K-573-2-1 | 1.268 | 1408.89 | 186.8 |
| IT97K499-35 | 1.578 | 1753.33 | 164.9 |
| Asomdwe | 1.645 | 1827.78 | 140.6 |
| Bambey21/UCR779 – 3 | 0.842 | 935.56 | 281.8 |
| Bawuta | 0.893 | 992.22 | 157.7 |
| LSD 0.65kg | | VALUES? | 10.02g |

Table 1 shows the yield of the cowpea evaluated. Yield per plant ranged from 0.855kg/ha to 1.645 kg/ha reflecting their yields estimated yield per heactare. The 1000 seed weight ranged from 118g in Ayiyi to 281.8 in Bambey 21/UCR 779 – 3. The established varieties used as CBGh, Ayeyi and "Vidiza" yielded higher but were not significantly different from the new lines. However, they (Ayeyi and Vidiza) had significantly smaller seeds than most of the new lines. In general yield increase as seed size decreases. Some of the new lines could become better alternatives to the current Ayiyi and Vidiza.

**Way forward:** It is proposed that the experiment to estimate the optimum planting distances and yield evaluation for the advance lines developed be repeated in the target environment (Volta Region).

**2.2.1 Project Title**: The performance of 5 selected pepper accessions in comparison with a local variety

**Principal Investigator**: S. K. Boateng

**Participating Scientists**: L.M. Aboagye, S. Akrofi, D. K. Gamedoagbao, K. F. Egbadzor, E. OseiOwusu, E.D. Boamah

**Objectives**: To compare growth and yield of 5 selected accessions to 2 local varieties.

To select pepper genotypes to boost non-traditional export.

**Key Results:**

**Table 2:** Evaluation of agro-morphological characteristics of Pepper genotypes

| Pepper genotypes | Plant height (cm) | Plant spread (cm) | No. of Fruits | Length of fruit (mm) | Width of fruits (mm) |
|---|---|---|---|---|---|
| A9A | 54.79 | 53.5 | 90.0 | 32.44 | 9.63 |
| A11A | 53.93 | 61.4 | 102.8 | 27.96 | 19.41 |
| A12A | 64.93 | 64.0 | 110.0 | 29.79 | 20.70 |
| SBL26 | 63.70 | 72.7 | 130.6 | 42.25 | 23.13 |
| CH8 | 44.88 | 54.4 | 72.7 | 14.51 | 15.81 |
| Abed | 46.46 | 41.1 | 29.4 | 27.77 | 21.94 |
| LSD (5%) | 5.416 | 8.08 | 34.57 | 5.705 | 2.426 |
| P | < 0.001 | < 0.001 | < 0.001 | < 0.001 | < 0.001 |

Table 2 shows the evaluation of agro-morphological characteristics of Pepper genotypes. Plant height ranged from 44.88 cm in CH8 to 64.93 cm in A12A with significant at $P < 0.001$. . Plant canopy was widest in SBL26 (72.7cm) and smallest in the local variety Abed1, 41.1 cm.

**2.2.2 Project Title**: The effect of leguminuous cover crops on growth and yield of garden eggs

**Principal Investigator**: S.K. Boateng

**Participating Scientists**: L.M. Aboagye, S. Akrofi, D. K. Gamedoagbao, K. F. Egbadzor, E. Osei Owusu, E. D. Boamah, D. Allotey

**Key Results**

**Table 3:** Phenotypic characters of garden eggs under different treatments

| Treatment | Plant height | Plant spread | Leaf length | Leaf width |
|---|---|---|---|---|
| Bareground | 46.05 | 82.1 | 18.89 | 12.57 |

| | | | | |
|---|---|---|---|---|
| Fertilizer | 49.28 | 85.7 | 18.97 | 12.75 |
| Soyabean | 54.65 | 95.1 | 19.31 | 13.16 |
| *Phaseolus* | 56.68 | 97.4 | 20.13 | 13.30 |
| *Mucuna* | 43.60 | 79.3 | 18.92 | 12.51 |
| LSD (5%) | 6.233 | 9.21 | 0.975 | 0.689 |
| P | <0.001 | <0.001 | 0.066 | 0.088 |

Table 3 shows the phenotypic characters of garden eggs under different treatments. Plant height of garden eggs plants was highest in *Phaseolus* treated plots (56.68 cm) and this was followed by the Soya bean plots (54.65 cm). These were significantly higher than the plants on the *Mucuna* treated plots (43.60 cm) and the bareground (Control) plots (46.05 cm, $P < 0.001$). Plant canopy was similarly widest in garden eggs plants on *Phaseolus* plots (97.4 cm), followed by soya bean plots (95.1 cm) and these were significantly higher the bareground (Control, $P < 0.001$). Leaf length and leaf width were similarly higher in the *Phaseolus* and Soyabean treated plots than the bareground plot.

**Table 4:** Fruit characteristics of the garden egg plants under different treatments

| Treatment | No. of fruits | Wgt. of fruits (g) | Fruit Length (mm) | Fruit Width (mm) |
|---|---|---|---|---|
| Bareground | 38.7 | 995 | 62.42 | 44.03 |
| Fertilizer | 39.8 | 1026 | 64.06 | 42.40 |
| Soyabean | 36.4 | 887 | 65.88 | 48.44 |
| *Phaseolus* | 45.3 | 1175 | 68.17 | 48.44 |
| *Mucuna* | 30.4 | 784 | 62.15 | 44.59 |
| LSD (5%) | 7.16 | 174 | 5.480 | 3.538 |
| P | 0.002 | <0.001 | 0.163 | 0.001 |

Table 4 shows the garden eggs fruit characteristics under the various treatments. The number of fruits per plant was highest in the *Phaseolus*(45.3) treated plots and was significantly higher than those on the bareground (38.7), soya bean (36.4) and *Mucuna*(30.4) treated plots. The weight of garden eggs fruits harvested was also highest in the *Phaseolus*(1175) treated plots and this was significantly higher than the bareground (995), soya bean (887) and *Mucuna* (784) treated plots.

**Way forward:** The best performing leguminous cover crops will be used in the next experiment and this will include *Canavaliaensiformis*.

**2.3Project Title:** Field evaluation and seed quality studies of some local garden eggs germplasm collected from three districts in Ghana.

**Principal Investigator**: N. G. Badger

**Objective**: To provide an acceptable quality seed for storage (longevity).

**Key Results**

**Table 5:** Vegetative data recorded

| Treat | Mean days to 50% germ. | Mean leaf Length (cm) | Mean leaf Width (cm) | Mean plant height (cm) | Mean Canopy Spread (cm) | Mean Days to 50% flowering | Mean Days To 50% Fruiting | Mean Plant Lodge (%) |
|---|---|---|---|---|---|---|---|---|
| FTD | 10 | 17 | 11.87 | 50.3 | 103.75 | 96.75 | 99.75 | 45 |
| ATD | 9 | 19.3 | 13.65 | 63.1 | 102.75 | 94.75 | 99.15 | 40 |
| EAD | 10 | 20.25 | 13.1 | 66.75 | 107.5 | 99.15 | 107.20 | 40 |

FTD= Fanteakwa district, ATD = Atiwa district, EAD = East Akim district

Table 5 shows the vegetative and inflorescence of the pepper in the three districts. data recorded. Mean days to 50% seed germination ranged fro 9 and 10 days. Mean leaf length ranged from 17 cm to 20.25 cm. Mean leaf width ranged from 11.87 days to 13.65 days. Plant heigh ranged from 50.3 days to 66.75 days. Mean canopy spread ranged from 102.75 cm to 107.5 cm. Days to 50% flowering ranged from 94.75 days to 99.15 days. The days to 50% fruiting ranged from 99.15 days to 107.2 days The degree of lodging ranged fro 40-45%.

**Way Forward:** It is proposed that the experiment would be repeated. Harvested fruits would be sorted and grouped accordingly; seeds would be extracted and seed quality analysis would be carried out before storage. A look at the fruit shapes would also be an area of priority as the experiment showed that non uniformity of fruits existed within each farmer saved seeds. Efforts would be made to obtain uniform fruit sizes and shapes for seed selection in breeding work.

**2.4.1 Project Title:** Participatory breeding and selection of taro

**Principal Investigator:** L.M.Aboagye

**Project Team:** D.Nyadanu, N. G. Badger and F.Omenyo.

**Objectives:** To evaluate, select and hybridize promising taro lines.

**Key Results**

**2.4.1 Agro-morphological characteristics**

**Table 6:** Performance of the accessions across four locations

| | Mean Plant Height (cm) | No. of Leaves | Plant Spread (cm) | No. of Suckers | % Leaf infection | Corm Yield (g) |
|---|---|---|---|---|---|---|
| Min | 20.5 | 2.2 | 25.7 | 0.3 | 0 | 130.0 |
| Max | 103.4 | 6.9 | 134.3 | 23.9 | 100 | 1033.0 |
| Mean | 62.8 | 4.2 | 69.8 | 6.4 | 0.2 | 414.1 |
| Standard deviation | 20.5 | 1.2 | 23.6 | 5.6 | 0.3 | 191.8 |
| CV % | 32.6 | 28.6 | 33.8 | 87.6 | 150 | 46.3 |

Table 6 shows the performance of the accessions across four locations. Mean plant height ranged from 20.5 cm (KA 39) to 103.43 cm (BLSM 132). The number of leaves ranged from 2.2 (BLSM 80) to 6.9 (BLSM 115). Plant spread ranged from 25.7 cm (ELO 5) to 134.3 cm (BLSM 135). The mean number of suckers ranged from 0.3 (KA 14 and BLSM 152) to 23.9 BLSM 116). The percentage leaf infection by Taro leaf blight (TLB) ranged from zero (BLSM 80 and CEIND 10) to 100% (KA 35). The corm yield ranged from 130g (SAO12) to 1033g (BLSM 80).

### 2.4.2 Organoleptic characterization:

**Table 7:** Scores, description and grouping of accessions

| Score | Description | Accessions |
|---|---|---|
| 3 | Excellent | Ex Bunso 1; BLSM 10; Ex Bunso 2; KA 19; CEMAL 32; KA 22/ BLSM 116; KA 21; BLSM 158 |
| 4 | Very good | BLSM 32; BLHW 37; Tumfa local |
| 5 | Good | BLSM 151, CEIND 12; KA 35 |
| 6 | Poor | Ex Bunso 3; BLSM 80; CEMAL 14; KA 24 and BLSM115 |

Table 7 shows the summary scores and description of the organoleptic properties namely: taste, texture, aroma and colour of the taro. The participants scored nine accessions as excellent, 3 as very good, three as good and five as poor. At least one local variety was scored in each category.

### 2.4.3 Genetic enhancement

A total of 280 crosses were made of which thirty-two (32) representing 14% were successful and seeds collected. The percentage success ranged from 10% in BLSM/115 X CEMAL/32 to

100% in KA/35 X BLSM/115, BLSM /80 X BLSM/16, CEMAL/32 X BLSM/116, CEMAL/32 X BLSM/16, CEMAL/32 X BLSM/151 and BLSM/16 X Tumfa local. The seeds from the crosses are being raised for distribution for on-farm evaluation of the $F_{1.}$

WAY FORWARD

The F1 seeds of the various crossings would be compared with the parents under field conditions with active participation by farmers.

**PLANT GENETIC CONSERVATION DIVISION**

**3.0 Tissue Culture Section**

**3.1 Project Title:** Protocol formulation for *in-vitro* conservation of *Allium cepa* var. *aggregatum*(shallot).

**Principal Investigator**: N. A. Asomani

**Objective**: Develop a protocol for*in-vitro* conservation of *Allium cepa* var. *aggregatum*(shallot) using mature bulbs.

**Key Results**

**1. Experiment with fungicide and antibiotic to reduce contamination of initiated shallot cultures.**

No fungal contamination was observed in shallot cultures on MS medium with cadbendazim after 72 hours of inoculation. However 56% fungal contamination was observed in cultures grown on MS medium only. Table 1 shows the effect of Carbendazim and Chloramphenicol on microbial contamination and shoot regeneration of shallot cultures after 2 weeks of initiation.

**Table 8:** Effect of Carbendazim and Chloramphenicol on microbial contamination and shoot regeneration of shallot cultures after 2 weeks of initiation.

| Treatment | Fungal contamination (%) | Bacterial contamination (%) | % sprouted shoots |
|---|---|---|---|
| MS medium only | 66 | 23.1 | 7.7 |
| MS medium + Carbendazim | 0 | 15.4 | 41.2 |

Table 8 shows the effect of Carbendazim and Chloramphenicol on microbial contamination and

shoot regeneration of shallot, 2 weeks after initiation. When sub-cultured, new shoots sprouted in 86% of the shallot sub-cultures and 69% developed roots after 8 days of sub-culturing. Only 8.3% fungal and bacterial contaminations were observed. After two weeks of initiation, percent developed shoots from ex-plants ranged from 48.3% to 66.7%.Seventy percent of cultures initiated on hormone free MS medium developed roots. Cultures on hormone free MS medium produced the greatest number of new shoots (83%), of which 65% developed roots. Moreover, the least percentage of dried leaves after six weeks was observed in cultures growing on hormone free medium.

**3.1.2. Project Title:** Introduction of root and tuber accessions *in-vitro* and maintenance of PGRRI *in-vitro* gene bank

**Principal Investigator**: N. A. Asomani

**Objectives:** To introduce root and tuber accessions not in culture *in-vitro* and maintain the PGRRI *in-vitro* genebank.

**Key Results:** Eighteen (18) new cassava and eight (8) new yam accessions were added to the *in-vitro* genebank. Ninety-seven (97) cassava and twenty-two (22) yam accessions that were either lost or had retarded growth in the genebank were re-introduced.

Twenty-three cocoyam accessions were initiated to replace lost accessions. Surface sterilization with 70% ethanol and 0.1% mercuric chloride with 0.05% Tween 20 for 10 minutes each prevented contaminations at the initiation stages. However the contamination was present again at the sub-culture stage due to presence of endogenous microbes in the corm tissues. Fifty-three (53) cultures of Plantain (*apantu*) were initiated for micro propagation. The state of the *in-vitro* gene bank as at December 2015 is given in figure1.

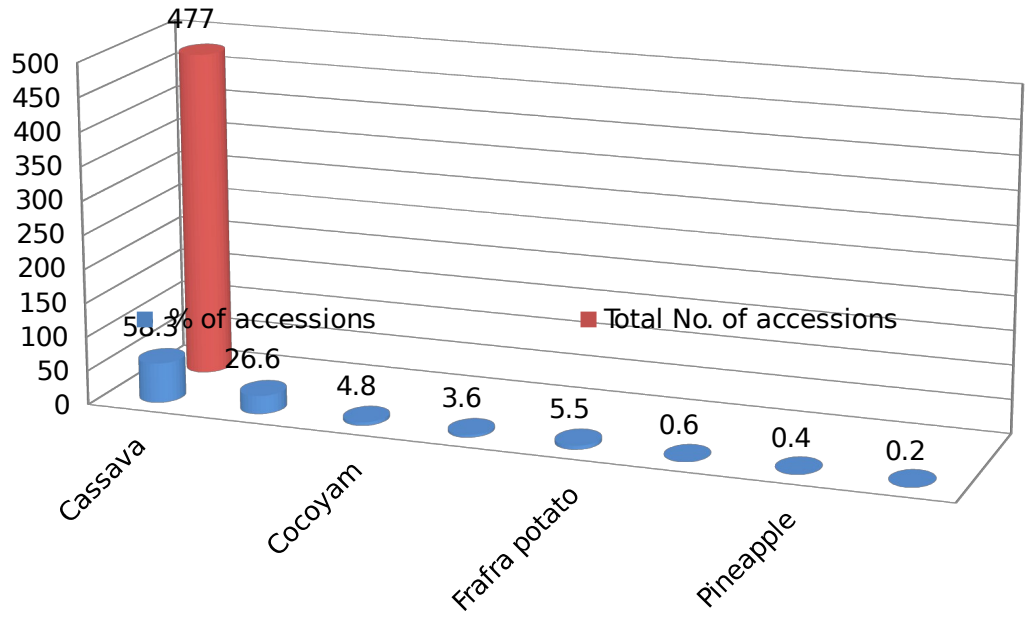



**Fig**. 1 State of the *in-vitro* gene bank as at December 2015

**Way Forward:** Root and tuber accessions which are not in culture will be introduced into the *in-vitro* gene bank. The in vitro gene bank will be maintained by periodic sub-culturing of accessions in the gene bank.

**3.1.3. Project Title:** Characterization of taro (*Colocasia_esculenta* (L.) Schott) biodiversity in Africa: *In-vitro* conservation of *Colocasia esculenta* (l.) Schott (taro) under slow growth conditions.

**Principal Investigator**: N. A. Asomani

**Objective**: Develop an efficient *in-vitro* conservation strategy for Taro varieties from Burkina Faso, Cote d'ivoire, Ghana, Nigeria and Tanzania under slow growth conditions on tissue culture medium.

**Key Results:** A project inception meeting of all collaborators from the project participating countries (Burkina Faso, Cote d'Ivoire, Ghana, Nigeria and Tanzania) was organized and held at the Ampomaah Tourist Hotel in Accra on 28$^{th}$ – 29$^{th}$ July 2015. All participants presented seminars on the "Key activities and methodologies to be used in their individual research projects among others. Sixty (60) taro accessions were collected in all, from nineteen (19) districts in the Ashanti (15), Eastern (2) and Western (2) regions. The collector's numbers

assigned to the collection ranged from ADA 2015 001 to ADA 2015 060 (ADA – Asomani Antwi, Danso, Adadey). Majority of the materials collected were young plants which had not developed corms yet. The taro accessions were collected from backyard gardens, farms, waterlogged areas and markets (roadside stalls).

**Way Forward:** The collected taro germplasm will be planted under field conditions for characterization.

**3.1.4 Project Title:** Contributions of different types and rate of fertilizer on the growth, yield and post-harvest qualities of cocoyam varieties.

**Principal Investigator:** S. K. Owusu

**Objective:** To determine which fertilizer type and dosage extend the shelf life of cocoyam.

**Table 9:** Measurement of the cocoyam plants taken at the 12th week after transplanting

| Treatments | Average height (cm) | Average length (cm) | Average breath (cm) |
|---|---|---|---|
| 1 | 7 | 34 | 32 |
| 2 | 82 | 35 | 33 |
| 3 | 84 | 35 | 34 |
| 4 | 84 | 36 | 33 |
| 5 | 72 | 34 | 32 |
| 6 | 76 | 35 | 33 |
| 7 | 78 | 35 | 33 |
| 8 | 74 | 32 | 31 |
| 9 | 86 | 36 | 34 |
| 10 | 72 | 32 | 30 |
| 11 | 76 | 33 | 32 |
| 12 | 80 | 36 | 34 |
| 13 | 82 | 35 | 33 |
| 14 | 84 | 34 | 33 |
| 15 | 80 | 35 | 33 |
| 16 | 82 | 35 | 33 |

Table 9 shows the measurement of the cocoyam plants taken at the 12th week after transplanting. Average height ranged from 7cm (T1) to 86cm (T9). Average length ranged from 35cm (T8, T10) to 40cm (T4) while average breath ranging from 31(T10) to 34 cm in T3, T4 and T 12,

**Table 10:** Measurement of the cocoyam plants at the 20th week after transplanting

| Treatments | Av. Ht (cm) | Av. Length (cm) | Av. Breath (cm) |
|---|---|---|---|
| 1 | 9 | 36 | 35 |
| 2 | 86 | 38 | 36 |
| 3 | 88 | 39 | 36 |

| | | | |
|---|---|---|---|
| 4 | 88 | 40 | 38 |
| 5 | 75 | 37 | 35 |
| 6 | 77 | 37 | 35 |
| 7 | 80 | 38 | 36 |
| 8 | 79 | 37 | 35 |
| 9 | 88 | 39 | 36 |
| 10 | 76 | 35 | 31 |
| 11 | 80 | 39 | 36 |
| 12 | 85 | 39 | 35 |
| 13 | 87 | 39 | 34 |
| 14 | 86 | 37 | 34 |
| 15 | 82 | 37 | 34 |
| 16 | 84 | 37 | 34 |

Table 10 shows the measurement of the cocoyam plants at the 20th week after transplanting. Average height of the cocoyam plants at the 20th week after transplanting ranged from 9cm (1) to 88cm (Treatment 3, 4 & 9). Average length of cocoyam plant ranged from 35cm (Treatment 10) to 40cm (Treatment 4) and average breadth ranged from31cm (Treatment 10) to 38cm (Treatment 4).

## 4.0 PLANT PROTECTION DIVISION

### 4.1 Plant Pathology

**4.1.1 Project Title:** Development of Control Measures for cassava root rot (CRR) disease in the Eastern Region of Ghana.

**Principal Investigator:** S. Akrofi.

**Project Team:** E. A. Moses, G. Bolfrey-Arku, K. Akuako, E. D. Boamah, G. Quansah, F. Owusu-Ansah

**Objectives**

(i) To determine the incidence and severity of cassava root rot (CRR) disease in the Forest and Transition zones of the Brong Ahafo region.

(i) To identify the causal organism(s) of the cassava root rot disease and its host range.

(ii) To identify cultural practices that favourthe spread and persistence of cassava root rot disease in these areas.

(iii) To identify and select improved cassava varieties and local cultivars with resistance/tolerance to cassava root rot (CRR) disease.

(iv) To train and equip farmers and extension staff with simple skills that will enable them identify and control cassava root rot disease.

**Key Results**

*Incidence and Severity of cassava root rot disease and other major cassava diseases*

The incidence and severity score of cassava root rot (CRR), African cassava mosaic virus (ACMD), cassava bacterial blight (CBB) and cassava anthracnose (CAD) diseases in farmers' fields in the Forest (Wamfie-Dormaa East district), Humid Savanna (Nsoatre-Sunyani West district) and the Transition (Asuona-Nkoranza South district) zones are presented in Tables 11and 12 respectively.

**Table 11:** Disease incidence of cassava root rot and other major diseases in the three agro-ecological zones of the BrongAhafo region

| Agro-eco zone | Location | CRR (Range) | ACMD | CBB | CAD |
|---|---|---|---|---|---|
| Forest | Dormaa East | 62.5% a (0-100% ) | 25.6% b | 20.0% a | 20% a |
| Humid Savanna | Sunyani West district | 25. 7% a (0-83.3%) | 31.6% b | 15.8% b | 15.8% b |
| Transition | Nkoranza South district | 34.8% a (0-85.7%) | 45.0% a | 20.0% a | 12.5% b |

Table 11 shows the disease incidence of cassava root rot and other major diseases in the three agro-ecological zones of the Brong-Ahafo region. Incidence of CRR was higher in the Forest (62.5%) than in the Transition (34.8%) and Humid savannah (25.7%) zones however, these differences were not significant. In the Forest zone ranged from 0 to as high as 100%. The relatively more humid environmental conditions in the forest zone may have provided a more favorable condition for the pathogens of cassava root rot disease to thrive than in the Humid savannah and Transition zones. Incidences of ACMD, CBB and CAD varied significantly across the three agro-ecological zones ($F = 48.7, df = 2, 103, p < 0.01$) ($F = 7.17 df = 2, 103, p < 0.01$) and ($F = 8.37, df = 2, 103, p < 0.01$). The Transition zone had a significantly higher incidence of

ACMD than in the Forest ($p < 0.01$) and Humid savannah ($p < 0.01$) zones but the incidence of CBB was significantly lower than in the Forest zone ($p < 0.01$).

**Table12:** Disease severity of cassava root rot and other major diseases in the three agro-ecological zones of the Brong-Ahafo region

| Location | Agro-eco zone | CRR | ACMD | CBB | CAD |
|---|---|---|---|---|---|
| Forest | Dormaa East | 3a* | 2b | 3a | 2b |
| Humid Savanna | Sunyani West | 3a | 2b | 2b | 3a |
| Transition | Nkoranza South | 3a | 3a | 3a | 2b |

* Figure follow the same letter in a column are not significantly different at 0.01%

Table 12 shows the disease severity of cassava root rot and other major diseases in the three agro-ecological zones of the Brong-Ahafo region. There were no significant differences in the severity rating of cassava root rot disease across the three agro-ecological zones (Table 12). The Transition zone had a significantly higher severity rating of ACMD than in the other two agro-ecological zones.

2. *Isolation and identification of fungi associated to cassava root rot in the laboratory*

The fungi that were isolated from the samples of rotten cassava tubers were *Aspergillus niger, Aspergillus flavus, Fusarium spp. Lasiodioplodia theobromae, and Sclerotuim rolfsii*. The most commonly isolated fungus across the three agro-ecological zones was *Lasiodioplodia theobromae.*

*3. Assessing Farmers knowledge on cassava root rot disease*

All the respondents were aware of cassava root rot disease and indicated that the disease had occurred in their farms at one time or other affecting yield of cassava and the disease was prevalent throughout out the year and it occurred whether cassava is sole cropped or in association with other food crops.

Most (70%) of the causes of the disease were not known (20%) but others think it may be due to under shade or by cultivating cassava on herbicide treated fields. No managed practice was in place and local cultivars *Abenewoha, AfiaKofie* and *Ahenewaa* are susceptible to cassava root rot whilst *Bankye Kokor* and *Bankye* Pole tolerant to the disease and improved variety *Afisiafi*, is reported to be susceptible while *Bankyehemaa* and *Nkabom* less susceptible.

*Establishing farmers' practices which promote the spread and persistence of cassava root rot disease*

In the Humid savanna zone respondents cultivated cassava on the same piece of land for at least three consecutive years; the sequence was a sole crop of cassava in the first two years followed by maize intercropped with cassava in the third year after the previous crop of cassava had been harvested. Similarly, the respondents from the Transition zone indicated that a selected farm land is allocated to a specific crop based on the soil type, and so a piece of land allocated to cassava was continuously cropped with cassava for not less than three consecutive years. The continuous cropping of cassava on the same piece of land is likely to increase the buildup of cassava root rot pathogens. Local cultivars of cassava which were early maturing could be harvested from one year after planting, but the majority (87%) of the respondents harvested gradually depending on their needs for domestic use. Majority (82%) of the respondents were aware that the cultivation of cassava year after year on the same piece of land could reduce soil fertility. Most (74%) of the respondents perceived that the growth of weeds enhances disease incidence and insect pest infestation and must be controlled as quickly as possible. Across the focus groups, lack of market for the harvest was top-ranked as another major constraint to cassava production. The respondents were also concerned about the lack of a cassava growers' association which could facilitate better marketing opportunities and the need for education in modern farming practices in cassava production.

**Way Forward:** Field visits will be carried out with farmers and Agricultural Extension Staff at 6, 9, 12, 18 months after planting to examine and score the cassava genotypes for susceptibility/tolerance to ACMD, CBB and CAD concurrently using the disease rating scales indicated earlier.

**Project Title:** Evaluation of *Capsicum* species land races for tolerance to Pepper mild mottle virus disease: Effect of Tri-sodium phosphate ($Na_3PO_4$) on seed germination of *Capsicum* species land races

**Principal Investigator:** E. Osei Owusu

**Participating Investigator:** S.Akrofi, E. N. Ahiatsi, A.Oppong

**Objective:** To assess the tolerance level of ten promising accessions of *Capsicum* species to pepper mild mottle virus (PmMV) disease on-farm.

**Key Results:** Germination rate of nursed seeds were over 90%. Seeds took 2 weeks to germinate. Transplant was done 3 weeks after germination. No symptoms of mild mottle virus disease was observed on seedlings at the nursery.

Survival of the pepper accession at the flowering stage was high. Minimum percent survival was 86%. Leaf mottling symptoms, an evidence of pepper mild mottle virus (PmMV) disease was observed on all the pepper accessions except accession ALM at the flowering stage. Severity of the disease as observed was generally mild. No death was associated with the disease. Table 10 below summarizes the observation.

**Table 10:** Survival and pepper mild mottle virus (PmMV) disease assessment of pepper accessions at flowering stage

| **Accession** | **% Survival** | **Incidence** | **Severity** |
|---|---|---|---|
| SBL 23 | 100 | 100 | 2 |
| DAB 001 | 86.67 | 100 | 2 |
| ALM | 86.67 | 0 | 0 |
| SBL 1 | 93.33 | 100 | 2 |
| 12 G | 93.33 | 100 | 3 |
| SBM 2 | 100 | 100 | 1 |
| 10A | 86.67 | 100 | 1 |
| SBM 12 | 86.67 | 100 | 2 |

Table 10 shows the survival and pepper mild mottle virus (PmMV) disease assessment of pepper accessions at flowering stage. Percentage survival ranged from 86.67cm (DAB 001/ALM/10A/SBM 12) to 100% (SBL 23).

**Table 11:** Growth assessment of pepper accessions at flowering stage

| **Accession** | **Mean height(cm)** | **Mean girth (mm)** |
|---|---|---|
| **SBL 23** | 103.16 | 9.54 |

| | | |
|---|---|---|
| **DAB 001** | 71.14 | 6.94 |
| **ALM** | 39.92 | 6.5 |
| **SBL 1** | 84.78 | 8.38 |
| **12 G** | 69.92 | 6.62 |
| **SBM 2** | 79.33 | 8.42 |
| **10A** | 66.45 | 7.09 |
| **SBM 12** | 76.49 | 7.64 |

Table 11 shows the growth assessment of pepper accessions at flowering stage. Mean height ranged from 39.92cm (ALM) to 103.16cm (SBL 23). Mean girth ranged from 6.5cm (ALM) to 9.54cm (SBL 23). Growth comparison is better appreciated with the girth measurement since all the accessions do not grow upright. Accession SBL23 was highest in height and girth. Accession ALM was the least in height and girth. Yield comparison is better appreciated with the total fruit weight. Accession ALM died off after 3 months of transplant. Accession SBM 2 yielded highest in fruit number and weight. Accession ALM recorded the least fruit number and weight due to its short life span of 3 months.

**Table 12:** Yield assessment of pepper accessions after six months of transplant

| **Accession** | **Fruit Number** | **Fruit Weight (g)** |
|---|---|---|
| SBL 23 | 974 | 1507.58 |
| DAB 001 | 1072 | 1308.96 |
| ALM | 56 | 98.67 |
| SBL 1 | 907 | 1834.13 |
| 12 G | 433 | 547.36 |
| SBM 2 | 1271 | 1840.07 |
| 10A | 1205 | 1614.54 |
| SBM 12 | 572 | 895.35 |

Table 12 shows the yield assessment of pepper accessions after six months of transplanting. Fruit number ranged from 56 (ALM) to 1271 (SBM 2) whereas fruit weight ranged from 98.67g (ALM) to 1840.07 (SBM 2). No resistance to pepper mild mottle virus (PmMV) disease was identified in the eight promising pepper accessions screened. There was a high degree of tolerance to pepper mild mottle virus (PmMV) disease in the eight promising pepper accessions screened.

**Project Title:** Domestication of *Tetrapleura tetraptera* in Africa: Development of vegetative propagation techniques and tree planting in collaboration with local communities

**Principal Investigator:** E. Osei Owusu

**Participating Scientists:** C. Elusiyan, P.Bosu and E. Kemigisha

**Objective:** Develop vegetative propagation technique(s) for multiplication of promising *Tetrapleura tetraptera* from Ghana, Nigeria, Uganda and other sources in Africa For cultivation; build capacity of small-holder farmers to integrate *Tetrapleura tetraptera* in agro-forest and other tree-based system; and increase the population plot of the tree in tropical Africa to maximize economic benefit.

**Key Results**

**Table 13:** Percent germination of and mean height *Tetrapleura tetraptera* germplasm after five months of sowing

| ***Teterapleura tetraptera* germplasm** | **Source** | **% Germination** | **Mean Height(cm)** |
|---|---|---|---|
| UGBUNT 001 | Uganda | 70.0 | 47 |
| UGKAKI 001 | Uganda | 87.5 | 46.6 |
| UGBUNT 002 | Uganda | 85.0 | 45.4 |
| UGBUBU 001 | Uganda | 85.0 | 47.6 |
| UGBUBU 002 | Uganda | 54.2 | 35 |
| UGMAMY 003 | Uganda | 82.5 | 39 |
| UGBURO 001 | Uganda | 60.0 | 36.8 |
| UGMANY 002 | Uganda | 52.5 | 38.8 |
| UGBUKA 001 | Uganda | 77.5 | 39.6 |
| TETENG 03 | Nigeria | 40.0 | 38.4 |
| TETENG 05 | Nigeria | 87.5 | 46.8 |
| GHWENT 1 | Ghana | 90.0 | 41.4 |
| GHTZD 03 | Ghana | 80.0 | 36.8 |
| BIA TANO 02 | Ghana | 60.0 | 42.6 |
| GHMSB 02 | Ghana | 25.0 | 18.8 |

Table 13 shows the percent germination and mean height of *Tetrapleura tetraptera* germplasm after five months of sowing. Seeds from Uganda had percentage germination ranging from 52.5 (UGMANY 002) to 85.0 (UGBUBU 001). Percentage germination of seeds from Nigeria ranged from 40 (TETENG 03) to 87.5 (TETENG 05) and seeds from Ghana ranged from 80 (GHTZD 03) to 90 (GHWENT 1). Mean plant height (cm) materials from Uganda ranged from 35cm (UGBUBU 002) to 47.6 cm (UGBUBU 001), that from Nigeria ranged from 38.4 cm

(TETENG 03) to 46.8cm (TETENG 05) and that from Ghana ranged from 18.8cm (GHMSB 02) to 42.6 cm (BIATANO 02).

A total of 70 households and 30 sellers of *T. tetraptera* were enumerated. Survey data were sent to project socio-economic scientist in Uganda for analysis. Seeds extracted from friuts of 14 genotypes of *T. tetraptera* collected from communities within the Fanteakwa and Suhum Kraboa-Coaltar districts of the Eastern Region of Ghana were sent to collaborating institutions in Ghana, Nigeria and Uganda for provenance trials and phytochemical analyses. Fifteen genotypes of *T. tetraptera* received from collaborating institutions in Ghana, Nigeria and Uganda are being raised for distribution to farmers.

A total of 426 seedlings have been raised out of 600 seeds sown.

**Way Forward:** The work is 70% complete. Development of Vegetative propagation technique is on-going. Raised *T. tetraptera* seedlings will be distributed to farmers at Fanteakwa and Suhum Kraboa-Coaltar districts for planting.

**Project Title:** Development of technology on conservation of genetic resources in Ghana: The case for eggplant and pepper

**Principal Investigator:** E. Osei Owusu

**Objectives**

1. To understand the current status of genetic resources conservation and management of Korea-Africa Food (and Agriculture Cooperation Initiative (KAFACI) member countries.
2. To enhance capacity on conservation and management of genetic resources through training.
3. To determine major genetic resources to be conserved.
4. To develop standardized genetic resources management system for KAFACI member countries

**Key Results**

1. Country report on the status of agriculture and plant genetic resources management system submitted and published.

2. Principal investigator has been trained in germplasm management systems at the National Agro biodiversity center, National Academy of Agricultural Science of the Rural Development Administration, in the Republic of Korea
3. Proposal for 2015-2016 activities submitted and under review

**Way Forward:** 2016 project activities will commence. Hundred accessions each of pepper and eggplant regenerated, characterized and evaluated using National Agro biodiversity center standardized methods for resistance to anthracnose of pepper and eggplant.

### 4.2.0 Entomology Section

**4.2.1 Project Title:** Integrated management of *Plutella xylostella* (DBM) and *Leucinodes*

**Principal Investigator:** E. D. Boamah

**Project Team:** S. Akrofi, D. K. Gamedoagboa, Egbadzor, K. F., E. O. Owusu, K. Afreh-Nuamah, H. Davies, E. F. Appiah, A. N. Eyram, F. Addo-Okyireh

**Objectives:** To increase production of cabbage and garden eggs through the development and dissemination of an integrated pest management (IPM) strategy for *P. xylostella* and *L. orbonalis*.

**Key Results:** Males dominated the production of garden eggs in both Afadzato South and North Dayi districts with a mean distribution of 70.3% and females 29.7% respectively. Common garden egg varieties grown in the study area were Long purple, Black beauty, Florida market, Ntrowa pa, Ojwanshua, Baby aubergines (Ravaya) and Kpando with Kpando (Improved) dominating on about 85% of the farms.

The seeds of these varieties were obtained from the market (65.3%), fellow farmers (29.6%) and researcher (5.1%) and these varieties were susceptible to pest and disease especially fruit and stem borer. Eggplant fruit and shoot borer (EFSB) *L. orbonalis* infestation on all the farms visited was above 70% and some common diseases were blossom end rot, vascular wilt and blight disease.

Farmers (91%) used broad spectrum pesticides Lambda cyhalothrin, Deltamethrin, Acetamiprid, Chlorpyrifos, Cypermethrin, Fenvalerate and Dimethoate in controlling pest on their farm. Spraying is defensive in nature as farmers spray weekly interval whether the pest is there or not. Respondents end up spraying between (16-20.) times during cropping season.

**Pesticide residue level analysis (determination):** Five (5) communities were selected from the two garden egg growing districts. Three (3) communities, namely Have Ando II, Sadzkope , Tafi Abuife from Afadzato South district and two (2) communities Aneta, Vakpo Dunyo from North Dayi district respectively. Five eggplant farms were also selected from each community. Three (3) garden eggs fruits of average weight of 65g each were picked from the middle of each farm. The fruits were put into polythene bags labeled the Ghana Standard Authority`s (GSA) laboratory for residue analysis

**Table14:** Analytical report

| Test conducted | EU MRLs for Eggplant | Unit mg/kg | 5 garden egg growing communities | | | | |
|---|---|---|---|---|---|---|---|
| | | | Sadzikope | Have Ando 2 | Tafi Abuife | Aneta | Vakpo Dunyo |
| Fenvalerate | 0.06 (max) | " | <0.01 | <0.01 | <0.01 | <0.01 | <0.06 |
| Deltamethrin | 0.30 (max) | " | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |

Table 14 shows the analytical report. Although fenvalerate and deltamethrin residues were detected in garden eggs samples from all the five (5) communities in the two (2) districts they were within the FAO/WHO maximum residue limits (MRLs), as indicated by table 14 above.

## 5.0 Commercialization and Information Division

## 5.1 Commercialization Section

**Project Team:** L. M. Aboagye, M. B. Briamah, P. Somevi, G. Oppong

INCOME AND EXPENDITURE STATEMENT
INTERNALLY GENERATED FUND
JANUARY - DECEMBER, 2015

| INCOME | GH¢ | GH¢ | GH¢ |
|---|---|---|---|
| Sale of Seedlings: | 84,489.80 | | |
| Sale of Fruits: | 28,508.457 | | |
| Spices: | 95.00 | | |
| Sale of Tubers: | 200.00 | | |
| Sale of Trees: | 300.00 | | |
| Other Services | 2,400.00 | | |
| | | 116,693.25 | |
| DIRECT EXPENDITURE | | | |
| Less Direct Expenditure | | 72,027.00 | |
| | | 44,666.25 | |
| Less 15% Payable to Head Office | | 6,699.94 | |
| 85% IGF | | 37,966.31 | |
| OTHER EXPENDITURE | | | |
| Less Other Expenditure | | **47,358.25** | |
| Loss of Income over Expenditure | | **(9,391.94)** | **47,358.25** |

## 5.2 Library and Documentation Section

**Introduction:** The Library Section continued to provide information services to users during the year in the areas of lending, reference services, current awareness services, and selective dissemination of information to its users. In addition, various documentation activities were carried out during the period under review.

**Key Results**

**Acquisitions:** During the year under review fifty-three (53) information resources were added to stock. These were made up of journals, monograph, newsletter, staff theses and project work, annual reports, and handbooks. The Institute received towards the end of the year, a TEEAL Mini Computer & Accessories from Cornel University Albert R. Mann Library U.S.A. via ITOCA. In addition thirty (30) electronic books were added to the electronic books collection.

**User Services:** A total of 928 visits were recorded during the period. The main purposes of their visit to the library were to read library books, journals as well as to work on their laptops within the congenial environment offered by the library. Other services included the traditional functions of the library.

**Literature searches:** Six in-depth literature search requests were received and answered during the period under review. However, in the absence of Internet facility at the Library, the staff had to rely only on offline resources to answer the requests.

**Work on Directory of the CSIR-PGRRI staff Publications:** The Directory of Staff Publications was updated and analyzed into major commodity covered, edited and revised to include a profile of the Institute in the preliminary pages.

The section is receiving completed questionnaires of staff whose articles have been listed in the directory for inclusion in the PGRRIREF directory.

**Database of farmers in the East Akim District Eastern Region of Ghana**

The section has developed a database of 1022 Farmers from four agricultural zones within the East Akim District in the Eastern Region of Ghana for research.

**Production of Annual and Quarter Reports:** CSIR-PGRRI 2013 and 2014 Annual Reports, fourth quarter report 2014, 2015 first, second, third and fourth quarter reports have been compiled and submitted to the CSIR Head Office.

## 6.0 ADMINISTRATION DIVISION

**Introduction**

The Annual Report covers the period from January to December 2015 and contains information on Administration/Human Resource activities during the period.

**Administration/Personnel:**

**Staff Strength:** The total number of permanent staff as at 31st December, 2015 was 136. This comprised of sixteen Senior Members; thirty-eight Senior Staff and eighty-two Junior Staff.

**Promotions:** Twenty-eight staff members were promoted during the year 2015. These were one senior member (Principal Research Scientist to Chief Research Scientist), four senior staff and twenty-five Junior Staffs.

**Staff on Study Leave:** Nine staff members were on study leave as at 31st December 2015. These included two PhD (University of Ghana, University of Port Hare South Africa), One MPhil(KNUST), One Bachelor of Administration (KNUST), one Science Laboratory Technician(Accra Polytechnic), one HND (Sunyani Polytechnic) and three Certificate in Agriculture (KwadasoAgric College, Adidome Farm Institute).

**Resumption of Duty:** Three staff members resumed duty after their study leave. They were: Robert Darko, Ebenezer Adu-Yeboah and Shine Anku.

**Meetings:** Seven meetings were held during the year 2015. These included two Management Board meetings, four Internal Management Committee meetings, an Emergency Internal Management Committee meeting, Estate Committee meeting and Human Resources Development meeting.

**Educational Visit:** Eighteen (18) visits were made to the Institute by lecturers, teachers, and students from some second cycle and tertiary institutions in the country.

**Workshops/Seminars/Conferences/Fairs attended**

**Mohammed B. Braimah**: Participated in the Orientation Seminar Toward Job Re-evaluation at Hephzibah Christian Ltd., Aburi on 25th February 2015.

**Dickson Korku Gamedoagbao** and **Paul Smart Osei-Kofi:** Participated in the following:

STI Technology Fair on the theme" Strengthening the private sector through Research, Technology and Innovation at the Ghana Technology University Colleague (GTUC) Tesano Campus near Ghana Police Training School, Abeka Junction, Accra, from Monday 30th to Tuesday 31st March 2015.

**Dickson Korku Gamedoagbao, Paul Smart Osei-Kofi and Regina Atawa Dogoe:** Participated in A three-day TEEAL-AGORA Training Workshop held at CRIG Club Conference Room 19th – 23rd May 2015 at New-Tafo Akim.

**Paul Smart Osei-Kofi** and **Regina Atawa Dogoe:** Participated in the following workshops:

- A four day technical workshop on TEEAL from 23rd to 26th March 2015 at CSIR-INSTI.
- A seminar on Ghana–Elsevier collaboration on 5thAugust 2015at African Regent Hotel in Accra.

**Emmanuel Ofori:** Participated in the Records Management Workshop at Ghana Musuem and Movement Board, Accra from 25th to 26th June, 2015

**Paul Smart Osei-Kofi:** Participated in the following:

- IFLA workshop at CSIR-INSTI on 29th June 2015.
- A three-day TEEAL-AGORA Training Workshop from 8th-10th September 2015 at CSIR-Forestry Research Institute of Ghana Kumasi.

**Paul Smart Osei-Kofi** and **Samuel Kwasi Owusu:** Participated in Show casing the institute's technology developed and research products at the MESTI Meet-the-press seminar at the Ministry of Communication Conference room, Accra, 10th-11th August 2015.

**Samuel Kwasi Boateng and Paul Smart Osei-Kofi:** Participated in the National Roving Seminar on making better use of Intellectual Property for business competitiveness and development in Africa at Golden Tulip Hotel, Accra, Ghana 13th-14th August 2015.

**Paul Smart Osei-Kofi**: Participated in a three-day Digitization of Library workshop at CSIR-Forestry Research Institute of Ghana Kumasi from 12th to14th October 2015.

**Mohammed B. Braimah**: Participated in Agriculture Public Expenditure Review at Coconut Grove Regency Hotelon 24th November, 2015

**Staff Seminar**

A research scientist and a librarian made presentations on 10th December 2015 at the CSIR-PGRRI Conference room. The topics were:

Challenges in breeding for seed size and yield in Cowpea [*Vigna unguiculata*(L.)Walp]. By

**Kenneth Fafa Egbadzor** and Benjamin Kemetse

Cloud Computing Application: Relevance for Research Scientists. By **Regina Dogoe Atawa**.

**Industrial Attachment and National Service Postings:** Twenty-One Students from the various Universities and Polytechnics undertook their industrial attachment at the Institute.

Nine National Service persons were posted to the institute for their National Service assignment.

**Transfer:** Four staff members were transferred from the Institute to CSIR Head Office (Mr. Philip Annor Nyamah), CSIR-Industrial Research Institute (Messrs. Dickson Korku Gamedoagbao, Aikins Gasu) and CSIR-Food Research Institute (Miss Regina Tsotsoo).

**Retirement:** Four staff proceeded on compulsory retirement from the service of the Council. These were Messrs. Christian Mpere Asare (Senior Research Scientist), David Oppong - Adu (Senior Security Officer), Evans Gayomeh (Senior Store Superintendent) and George Asomaning (Assistant Farm Manager).

## SOME IMPORTANT EVENTS

### Introduction of the new Director-General of CSIR to the Staff of the Institute

The new Director-General of CSIR Dr. V. K. Agyeman was introduced to the staff of the Institute on the 23rd of January, 2015.Present at the ceremony were Dr. A. B. Salifu the immediate past Director-General CSIR, Nana Adusei Peasah IV Tafohene and member of the Institute's Management Board, Mr. I. Adam the Ag. Director of Administration, CSIR, Mr. Yaw Painstil CSIR Legal Officer and Mr. Edward Decker Special Assistant to the Director-General.

**Visit by Kenyan Trade Mission to the Institute:** A Kenyan Trade Mission visited the Institute on 13th May, 2015 to familiarize themselves with the activities of the Institute.

**The Collapse of Canopy Walkway:** The canopy walkway at the Institute's Arboretum collapsed on 1st July 2015. A Commission of Enquiry was instituted by the Eastern Regional Minister to investigate the matter and since submitted its report. The Director of the Institute and the CSIR Lawyers appeared before the Committee.

**ESTATE SECTION:** The Section undertook minor and some major works at the Institute's bungalows, quarters and offices.

**TRANSPORT SECTION:** Some of the Institute's vehicles were serviced and their roadworthy certificate and insurance renewed. The Section took delivery of new number plates for government vehicles on 25th March, 2015.

**SECURITY SECTION:** Effective manning of security posts were ensured and also extensive patrol of the institute's plantations.

## APPENDIX I: PUBLICATIONS

### Refereed Journal Papers

1. **Aboagye L. M.,** D. Nyadanu, M. O. Opoku-Agyeman, S. K. Owusu and E. Asiedu-Darko E. (2015). Survey of diversity and production of yams in four communities in Southern Ghana. *African Journal of Agricultural Research 10*:24532459

2. **Aboagye, L. M.** and D. Nyadanu (2015). Some advances in plant genetic resources management in Ghana. *International Journal of Agricultural Research and Innovation 1(1):* 10-19.

3. **Asiedu-Darko**, E. and Amanor, M. (2015). A survey of public sector workers attitude towards annual leave. *Journal of Global Economics, Management and Business Research 2 (2*): 108-112.

4. Otoo, E., Opoku-Agyeman, M., Dansi, A., **Aboagye, L. M.,**Acheremu, K. and Tetteh, J. P. (20.15). Increasing farmers and breeders access to yam (*Dioscorea*spp) diversity: The case of Forest-Savannah Transition agro-ecology. *African Journal of Agricultural Research*: *10*:772-782.

5. Nyadanu, D., **Aboagye, L. M**. Akromah . R. A. Dansi, A. (2015). Agro-biodiversity and challenges of on-farm conservation: the case of plant genetic resources of underutilized crop species in Ghana. *Genet Resour Crop Evol Obtained from* DOI 10.1007/s10722-015-0327-2
   **Egbadzor, K. F.**[1.2*], Kwame, S.[5], Yirenkyi, E. D.[1], Daniel Ashie, D. K.[2],Gamedoagbao, D. K.[2], Dadoza, M.[3], Yeboah, M.[1] and Ofori, K.[4] (2015). Farmer participation in selectionwithin segregating populations of cowpeain Volta Region, Ghana. *Agric& Food Secur*Obtained from *4:17*DOI 10.1186/s40066-015-0037-1
   **Boateng, S. K. (2015).** Farmer perspective on the use of indigenous fruit trees in cocoa growing systems in Suhum Kraboa Coaltar District in the Eastern of Ghana. *Ghana Journal of Agricultural Science 49*: 205, 87-99

### Conference Papers

1. Aboagye, L. M. (2015). Harnessing alternative source of energy for National development, Science and Technology to the rescue. Paper presented at the Ghana Science Association 29th Biennial Conference of the Ghana Science Association, Universdity for Development studies, Tamale
2. Nyadanu, D., Akromah, R. and **Aboagye, L. M**. (2015). Diversifying diets using plant genetic resources of underutilized vegetables in Africa: A solution to malnutrition and management of non-communicable diseases. Paper presented at the 6th Annual Scientific Conference, College of Health Science, Kwame Nkrumah University of Science and Technology, Kumasi 27th-28th August, 2015
3. **Aboagye, L. M**. (2015). Promoting food security in a sustainable environment in Ghana. Paper presented at the 15th Annual General Meeting and Scientific Conference of the Ghana Institute of Horticulturists (GhIH), Crop Research Institute, Fumesua, Kumasi 17th to 18th September 2015

**Technical Reports**

1. **Asiedu-Darko, E.** (2015). An assessment of work related learning: A case study of an industrial attachment programmes. CSIR-PGRRI/RE/EAD/2015/67
2. **Asomani, N. A.** (2015). The effect of BAP and NAA on plantlet regeneration from basal portions of garlic (*AlluimsativumL.)*CSIR-PGRRI/RE/NAA/2015/66
3. **Asomani, N. A.** (2015. Micro propagation of *Cryptolepsissanguinolenta*: Effect of BAP, IBA and NAA on plantlet regeneration from \nodal cutting. CSIR-GRRI/RE/EAD/2015/65
4. **Bissah, M. N.** (2015). In-vitro establishment of *CryptolepisSanguinolenta(*Nibima) CSIR-PGRRI/RE/BMN/2015/64
5. **Osei-Kofi, P. S., Aboagye, L. M. and Dogoe, R. A.** (2015). Plant genetic resources literature on Ghana: Case study of CSIR-Plant Genetic Resources Research Institute. CSIR-PGRRI/RE/PSO/2015/63

**Directory**

1. **Osei-Kofi, P. S., Dogoe, R. A., Aboagye, L. M**. (2015). PGRRIREF Directory: Compilation of titles and analysis of scientific publications on plant genetic resources from Council for Scientific and Industrial Research-Plant Genetic Resources Research Institute, CSIR-PGRRI/DT/PSO/2015/1

**Thesis (2015)**

**Osei-Kofi, P. S**. (2015). Journals in the Council for Scientific and Industrial Research (CSIR) Ghana: Trend, challenges and the future. Thesis submitted to the Department of Publishing Studies, Kwame Nkrumah University of Science and Technology, Kumasi in partial fulfillment of the requirements for the degree of Master of Art in Publishing by Research CSIR-PGRRI/TH/PSO/2015/014

**Poster/abstract**

1. Towards the ideal cowpea for northern Ghana. Submitted for presentation at the world cowpea conference in Zambia 2016
2. Nyadanu, D., Akromah, R. and **Aboagye, L. M**. (2015). Diversifying diets using plant genetic resources of underutilized vegetables in Africa: A solution to malnutrition and management of non-communicable diseases. Paper presented at the 6th Annual Scientific Conference, College of Health Science, Kwame Nkrumah University of Science and Technology, Kumasi 27th-28th August, 2015
3. Aboagye, L. M., Nyadanu, D., and Badger, N. G. (2015). Taro (*Colocasia esculenta*) improvement in Ghana. Poster presented at the 31st Annual Farmers Day at Akim- Akropong in Atiwa District of Eastern Region, held 4th December 2015

## MEETINGS AND CONFERENCES

Dr. L. M. Aboagye, L. M. attended the Third Annual General Meeting of the International Network for Edible Aroids (INEA) at Santo, Vanuatu. 2-6 February, 2015

Dr. L. M. Aboagye, L. M. attended the 29th Biennial Conference of the Ghana Science Association, at the University for Development studies, Tamale on the theme: 'Harnessing alternative source of energy for National development, Science and Technology to the rescue'.

**Dr. L. M. Aboagye** Attended the 15th Annual General Meeting and Scientific Conference of the Ghana Institute of Horticulturists (GhIH), Crop Research Institute, Fumesua, Kumasi 17th to 18th September 2015 on the theme: Promoting food security in a sustainable environment in Ghana.

## Appendix I1: Divisions of PGRRI

### Administration Division

| No. | Name | Qualifications |
|---|---|---|
| 1 | Lawrence Misa Aboagye | BSc. Agriculture, MSc. Plant Physiology, PhD Plant Breeding and Physiology–Director |
| 2 | Emmanuel Asiedu-Darko | BA (Hons) Social Science, MPhil. Adult Education - Administrative Officer |

### Plant Genetic Conservation Division

| No. | Name | Qualifications |
|---|---|---|
| 1 | Matilda Ntowaa Bissah** | BSc. (Hons) Botany, MPhil Botany - Research Scientist |
| 2 | Naomi Asomani Antwi | MSc. Biological Sciences - Research Scientist |
| 3 | Samuel Kwasi Owusu | Dip. Post-Harvest Technology, BSc. Agriculture MPhil. Post-Harvest Technology -Research Scientist |

### Plant Genetic Diversity Division

| No | Name | Qualification |
|---|---|---|
| 1 | Samuel KwasiBoateng | BSc. (Hons) Botany, MPhil. Botany, PhD. (Plant Physiology) - Senior Research Scientist |
| 2 | Kenneth FafaEgbadzor | BSc.(Hons) Agric, MPhil. (Plant Breeding), PhD. (Plant Breeding) - Research Scientist |
| 3 | Nicholas Gbenartey Badger* | Dip. Extension and Farm Management,BSc. (Hons) Agric. - Assistant Research Scientist |

### Plant Protection Division

| No. | Name | Qualifications |
|---|---|---|
| 1. | Susana Akrofi | BSc. Agric., MPhil. Plant Pathology, PhD. (Agricultural and Environment) - Research ScientistAg. Head of Division |
| 2. | Daniel AshieKotey | BSc. ( Hons) Biology, MPhil. Entomology– Research Scientist |
| 3. | Emmanuel BoamahDuku | BSc.( Hons) Agric, MPhil Entomology - Research Scientist |
| 4. | Edmund OseiOwusu | BSc. Biology, MSc. Plant Pathology - Research Scientist |
| 5. | Emmanuel NorkplimAhiatsi Dip. | Ext. and Farm Management, BSc. (Hons) Agric. - Assistant Research Scientist |

**Commercialization and Information Division**

| No. | Name | Qualifications |
|---|---|---|
| 1 | Paul Smart Osei-Kofi | Dip. Archives Administration, BA(Hons) Social Science, MA Publishing Studies- Assistant Librarian |
| 2 | Regina AtawaDogoe | BA (Hons) Arts, Post Graduate Diploma in Library Studies - Librarian |

**Accounts Division**

| No. | Name | Qualifications |
|---|---|---|
| 1 | Mohammed Baba Braimah | BSc. Accounting, MBA Accounting and Finance - Senior Accountant, Head of Division |

*MPhil/MSc Student **PhD Student

**Appendix III List of Senior Staff**

| Senior Staff | Rank |
|---|---|

| | | |
|---|---|---|
| 1 | Mr. J. K. Oboe-Sam | Chief Purchasing Asst. |
| 2 | Mr. Edward K. Darkoh | Chief Tech. Officer |
| 3 | Mr. Robert Darko | Chief Tech. Officer |
| 4 | Mr. Philip Somevi | Chief Technical Officer |
| 5 | Miss. Catherine ElikemDzokoto | Chief Technical Officer |
| 6 | Mr. George Oppong | Chief Technical Officer |
| 7 | Mr. Abednego OpokuMensah | Principal Technical Officer |
| 8 | Miss Sophia Ackon | Principal Technical Officer |
| 9 | Mr. Ebenezer AduYeboah | Sen. Technical Officer |
| 10 | Mr. Emmanuel Ofori | Sen. Administrative Assistant |
| 11 | Miss Emma OseiBiriwaa | Sen. Accounting Assistant |
| 12 | Mr. Godwin Hussey | Sen. Works Superintendent |
| 13 | Mr. Isaac Tawiah | Sen. Asst. Transport Officer |
| 14 | Mr. NkansahBoakye | Sen. Asst Transport Officer |
| 15 | Mr. Samuel Abrokwa | Sen. Asst Transport Officer |
| 16 | Mr. Edward Sangmor Adams | Sen. Security Officer |
| 17 | Mr. Richard Aklatey | Sen. Security Officer |
| 18 | Mr. William AmoakoAntwi | Accounting Assistant |
| 19 | Mrs. AfuaAbayieOwusu-Korankye | Senior Accounting Assistant |
| 20 | Mr. John OheneAmpofo | Sen. Administrative Assistant |
| 21 | Mr. RansfordAgbedanu | Asst. Farm Manager |
| 22 | Miss. Juliana Samaah | Asst. Farm Manager |
| 23 | Miss Esther Adu | Sen. Stores Superintendent |
| 24 | Mr. Benjamin Sakyi | Technical Officer |
| 25 | Mr. Jonathan Siamey | Technical Officer |
| 26 | Mr. Peter KwakuNintang | Security Officer |
| 27 | Mr. Stephen Akuoko | Security Officer |
| 28 | Mr. HayfordHorsu | Security Officer |
| 29 | Mr. Martin OwusuOfori | Security Officer |
| 30 | Mr. Paul Amoah | Security Officer |
| 31 | Mr. Emmanuel Duodu | Asst. Transport Officer |
| 32 | Miss. EdusahAppiah | Technical Officer (Catering) |
| 33 | Mr. George Asomaning | Asst. Farm Manager |
| 34 | Mr. OrackDarko | Asst. Farm Manager |
| 35 | Mr. Lawrence Baah | Asst. Farm Manager |