WEST AFRICA AGICULTURAL PRODUCTIVITY PROGRAMME (WAAPP)

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Executive Summary

The West Africa Agricultural Productivity Project (WAAPP) is a two-phase, 10-year Adaptable Programme Loan (APL) of five years duration each, involving three countries: Ghana, Mali and Senegal. The development objective of the 10-year APL is to contribute to agricultural productivity increase in the counties' priority commodity sub-sectors that are aligned with regional priorities.
Ghana's priority crops are basically roots and tubers which include cassava, yam, cocoyam and sweet potato.
The project is being implemented through four (4) components as follows:

- Enabling conditions for regional cooperation in technology generation and dissemination.
- National Centre of Specialization (NCOS)
- Funding of demand-driven technology generation and adoption.
- Project coordination, management, monitoring and evaluation

WAAPP is in its third year of implementation. Key technical activities were carried out at the management and operational levels with some modest achievements.
The first half of the major rainy season, which spanned the period April-early June, had been very bad with poor rainfall, thus impacting negatively on the fortunes of many farmers along the coast who had planted their crops around that period. In spite of the initial drought experienced rainfall in the major season was good.
During the minor season different parts of the country experienced varied levels of rainfall. Most parts of the country experienced much higher levels of rainfall during the season which revived hopes for farming.
The Ministry of Food and Agriculture's development strategy is premised on the knowledge that agriculture has significant potential to grow beyond the levels experienced in recent years: that the high agriculture can only materialize through modernization and diversification, driven by public investment and productivity: and that modernizing agriculture can change the face of the rural setting and poverty. The overall objective of the agriculture modernization is to significantly increase the scale of production and productivity, enhance food security, create employment opportunities, and cut down on the use of foreign exchange for food imports.

On the economy, the country managed to weather the recession relatively well, supported by the favourable market conditions for gold and cocoa exports.

The performance suggests that the economy is expanding at a moderate rate. Provisional estimates from the Ghana Statistical Service the Central Bankput the real GDP growth far above 5%.

LIST OF ABBREVIATIONS AND ACRONYMS

AEA	Agricultural Extension Agent
AgSSIP	Agricultural Services Subsector Investment Programme
AKIS	Agricultural Knowledge Information System
AWPB	Annual Work Plan and Budget
CARGS	Competitive Agricultural Research Grants Scheme
COSMAC	Centre of Specialization Management Committee
CRI	Crops Research Institute
CSIR	Council for Scientific and Industrial Research
DADUs	District Agricultural Development Units
DAES	Directorate of Agricultural Extension Services
DCS	Directorate of Crop Services
DMISO	District Management Information System Officer
EPA	Environmental Protection Agency
FASDEP	Food and Agricultural Sector Development Policy
GPRS	Ghana Poverty Reduction Strategy
MDGs	Millennium Development Goals
M & E	Monitoring and Evaluation
MEO	Monitoring and Evaluation Officer
MOFA	Ministry of Food and Agriculture
MOFEP	Ministry of Finance and Economic Planning
NARS	National Agricultural Research Systems
NCOS	National Centre of Specialization
NPC	National Programme Coordinator
NPSC	National Project Steering Committee
PD	Projects Division
PPMED	Policy Planning Monitoring and Evaluation Directorate
PPRSD	Plant Protection and Regulatory Services Directorate
RADUs	Regional Agricultural Directorate Units
R & D	Research and Development
RELCs	Research Extension Linkages Committees
SRID	Statistics Research and Information Directorate
WAAPP	West Africa Agricultural Productivity Programme
WECARD/CORAF	West and Central African Council for Agricultural Development

1.0 INTRODUCTION

The West Africa Agricultural Productivity Project (WAAPP) is a two-phase, 10-year Adaptable Programme of five years duration each, involving three countries: Ghana, Mali and Senegal. It aims at generating and disseminating improved technologies in the country's priority areas that are aligned with the region's top priorities.

The project objective is to generate and disseminate improved technologies in Ghana's top priority areas that are aligned with the region's top priorities as identified by WECARD/CORAF. The project first phase is to set up a framework in sharing technology, establishing a national centre of specialization and funding of demand-driven technology generation and adoption.

The project has four components each with a set objective aimed at achieving specific goals. They include;

- Enabling conditions for regional cooperation in technology generation and dissemination.
- National Centre of Specialization (NCOS).
- Funding of demand-driven technology generation and adoption.
- Project coordination, management, monitoring and evaluation.

The project is satisfactorily progressing towards achieving its development objectives. Research activities have been intensified at the national centre of excellence with four varieties of cassava released.

2.0 OBJECTIVES

The project objective is to generate and disseminate improved technologies in Ghana's top priority areas that are aligned with the region's top priorities as identified by WECARD/CORAF. The project first phase is to set up a framework in sharing technology, establishing a national centre of specialization and funding of demand-driven technology generation and adoption.

The project has four components each with a set objective aimed at achieving specific goals.

Component one focuses on creating enabling conditions for Regional Cooperation in technology generation and dissemination.

This component aims at strengthening the mechanisms and procedures for the dissemination of technology. To achieve this aim, activities were carried out during the period under review for the realization of the set objective. Alignment of procedures with ECOWAS has intensified.

Component two is the establishment of national centre of specialization. The aim is to strengthen the alignment of national priorities with regional priorities within the participating countries national agricultural research systems (NARS). Research activities have intensified with four varieties released. Also field trial activities are on going.

Component three is funding of demand-driven technology generation and adoption.

It aims at strengthening priority-focused, transparent funding mechanisms for demand-driven agricultural research and development in Ghana. The Competitive Agricultural Research Scheme (CARGS) Board has commenced the approval of proposals for funding. This is initiative is expected to address production and post-production activities such as storage and problems. This will give market volume and value to produce to earn increased incomes.

Component is four project coordination, management, monitoring and evaluation. This is to establish an effective coordination management and M&E system at the national level.

The period under review witnessed the implementation of major programmes and activities that would lead to the attainment of project objectives.

Infrastructure development at the centre of specialization would enhance the work of researchers to produce results/outputs for realization of programme objectives in the area of the exchange programme.

3.0 RESULTS

Based on the principles of the results-based project management, the programme worked towards the realization of desired results and outcomes.

Research activities intensified and four (4) cassava varieties were released. These varieties are being promoted and disseminated in various agro-ecologies for adoption and to increase farmer incomes. The competitive grants scheme approved 12 proposals for research into farmer problems. Also, the National Varietals Release Committee (NVRC) initiated action on the harmonization of national procedures for the release of genetic materials in 2009. A draft manual of the procedures for the release and registration has been developed and circulated to research institutions for their comments. The draft manual has protocols for distinctness, uniformity, stability and value for cultivation or use for cassava, yam and maize. These protocols are based on those proposed by CORAF/WECARD.

Procurement processes for office equipment and computers have been completed and delivered.

The project baseline studies report for Ghana has been validated at both the national and regional levels.

One of the key requirements/ indicators is the existence of an operational information system on research and agricultural technologies. During the year under review, a web-based information system of CSIR-WAAPP for technology dissemination was established.

An efficient M&E system has been established together with all the necessary conditions and capacities required for the M&E outputs to make a valuable contribution to project decision-making and learning.

A regional steering committee meeting was held in Ghana to review programme implementation and approve work plans and budgets of the three participating countries.

4.0 ACTIVITIES

4.1 Component One: Enabling conditions for regional cooperation in technology generation and dissemination

1. Output One : National Procedures for the release and registration of genetic materials revised and harmonized with regional procedures

Introduction

The National Varietal Release Committee (NVRC) initiated action on the harmonization of national procedures for the release of genetic materials in 2009.

Actions and Outcomes

A draft manual of the procedures for the release and registration has been developed and circulated to research institutions for their comments and inputs. This manual has protocols for distinctness, uniformity, stability (DUS) and value for cultivation or use (VCU) for cassava, yam and maize.
The draft manual after collation of inputs and comments would be subjected to stakeholder consultation in January 2010.

2. Output Two: Efficacy Trials Protocols

The Plant Protection and Regulatory Services Directorate (PPRSD) of the Ministry of Food and Agriculture (MOFA) in collaboration with the Environmental Protection Agency (EPA) is implementing a component of the West African Agricultural Productivity Programme (WAAPP) which is to achieve an objective of the establishment of common regulation for the registration of pesticides in West Africa.

Draft efficacy trials protocols for testing of agricultural pesticides for the under-listed commodity crops and associated pests and disease combinations have been developed under humid conditions. These draft prepared protocols was validated at a sub-regional ECOWAS workshop for regional harmonization.

CROP		PEST/DISEASES
1.	Cocoa	Cocoa Mirids,
2.	Cocoa	Black pod disease

3. Oil Palm	Leaf Miner
4.Plantain/Banana	Black Sigatoga disease
5.Vegetables (Chillies)	Insect pests complex attacking vegetables
6.Mango	Anthracnose disease

Field testing of new reduced risk insecticide bait (GF 120) containing spinosad is being evaluated in four agro-ecological zones to support registration of the product to control the fruit fly menace. The evaluation which started in April 2009 was completed in June 2009. This is a collaborative study involving EPA, PPRSD, IITA and ECOWAS sub regional fruit fly management programme.

Activities have been carried out on the alignment of national laws to ECOWAS regulations on pesticides, release of genetic materials, and other crop protection products. The PPRSD and the EPA have participated in several meetings at the sub-regional level organized by ECOWAS for the harmonization of country laws. The ECOWAS regulations have been received for review and alignment of the national laws to the ECOWAS regulation.

4.2 Component Two: National Centre of Specialization (NCOS)

A) Cassava Programme

The goal of WAAPP cassava programme at CSIR-CRI is to contribute to improve security in West Africa through increased production and utilization of cassava. This will be achieved through development and dissemination of appropriate high yielding cultivars showing desirable characters and backed by good agronomic practices.

The following activities were carried out during the period under review:

1. **Release of Four (4) cassava varieties developed through participatory breeding**

Background

With the inception of WAAPP in 2008, WAAPP facilitated the final bits of the process which started in 2001 towards their release which included setting up of inspection plots, multi-locational testing, morphological, physio-chemical and functional characterizations and culinary test.
Four cassava cultivars developed through participatory breeding were passed for release by the National Varietal Release Committee (NVRC) in mid-October 2009.

Objectives

- To introduce diverse and high yielding varieties to meet different stakeholders needs and satisfy the emerging markets for different producers
- To develop cassava varieties tolerant to both biotic and abiotic stresses

Results

Some characteristics of the four newly released cassava varieties

Cultivar	Proposed name	Mean Root yield	Maturity Period (Months)	Total Dry matter	Uses	CMD resistance	Cyanide level	Fresh Root colour	Petiole colour
AW 1	CSIR-CRI Buroni bankye	59T/ha	12	35.5	Flour, Starch, poudability	resistant	Very low	Deep brown	Purple
AW 18	CSIR-CRI Ampong	40T/ha	12	32.8	Flour and bakery products	resistant	Very low	Brown	Yellow green
AW 34	CSIR-CRI Sika bankye	56T/ha	12	25.7	Starch, gari	Tolerant	Very low	Brown	Yellow green
K 25	CSIR-CRI Otuhia	65T/ha	12	38.6	Starch , flour	Resistant	Very low	Brown	Yellow green

Generally, the new varieties are superior to Afisiafi and Abasafitaa in terms of yield, dry matter and resistance to diseases and pests. They are also phenotypically distinct in terms of branching habits, stem and petiole colour.

2. Genetic crosses between landraces and improved varieties for the development of cultivars preferred by emerging markets

Introduction

Most high yielding improved cultivars released and disseminated to farmers were generally bred for processing into different intermediary forms before they are used. These cultivars do not meet farmers' immediate needs (i.e. poundable into f*ufu*). So adoption of these varieties is low.

Improving productivity of the farmer-preferred landraces and acceptability of exotic cultivars through genetic crosses (diallel crosses) is seen as the quickest way of helping farmers and other stakeholders to get the best from the national cassava programme.

Objectives

- To develop suitable varieties preferred by farmers and other stakeholders
- To improve farmers' access to a diversity of high yielding, disease resistant cassava clones appropriate to their needs and other end-users

Results

- 85% and 70% of improved and landraces respectively showed resistance to CMD at 6 MAP.
- 1,348 diallel crosses (amongst landraces and between landraces and IITA cultivars) have been made and tagged
- 471 introgressions (i.e. crosses between 60 landraces and TME 1) of CMD resistance have also been made and tagged.

3. Assembling and characterization of landraces and exotic clones (Cassava Diversity)

Introduction

Different cassava cultivars are often given the same name or single cultivar is given different names depending on where these cultivars are popularly found. This bulking of exotic cultivars into a single name "Agric" and the misrepresentation of the landraces call for a radical means of characterizing the existing germplasm in order to fasten the progress of the breeding programme.

Objectives

- To characterize by morphological and molecular means
- To avoid misrepresentation of cultivars
- To establish data base for correct identification and representation of cassava cultivars in Ghana

Results

- Preliminary morphological characterization based on petiole and stem colour,resistance to CMD, branching habits and canopy development indicated some similarities as well as variations among the cultivars assembled. This is being used as the starting point for putting the cultivars into clusters
- 165 landraces assembled at Fumesua and Ejura
- 96 elite exotic materials also assembled at Fumesua and Ejura

4. Multilocational participatory evaluation of elite cassava clones for food and industrial uses

Introduction

Multilocational evaluation of cassava cultivars using participatory approaches has served as a viable means of selecting and disseminating suitable cultivars to different stakeholders. This approach has also helped to shorten the duration for breeding cassava and increased adoption.

Objectives

- To elicit different stakeholders needs and preferences for the different cultivars
- To sensitize stakeholders on the attributes of different cultivars

Activities

- 8 elite clones have been established in augmented block design at Fumesua, Ohawu, Aworowa, Ejura and Anyinase
- Data on crop growth and development such as plant height, canopy spread and height of first branching were taken October/December
- Diseases assessment at 6 MAP was also carried out in September/October whilst pests assessment has been scheduled for November to February 2010.

5. **Evaluation and validation of pre-and post-harvest traits of all released cassava varieties across different ecological zones of Ghana**

Introduction

Most of the released varieties have started showing signs of poor performance due to their breakdown of resistance to diseases and pests. Others are also showing post-harvest traits which are contrary to those reported at the time of their release. The adverse effects of climatic change which have resulted in reduced amount of rainfall and low soil productivity, cassava is seen as a crop with high adaptability to such harsh conditions. This calls for maintenance breeding to maintain the already released varieties.

Objectives

- To determine their suitability for food and industrial uses
- To critically review their performance in different ecological zones

Results

- Planted all (14 varieties) released at Fumesua, Ejura, Ohawu and Anyinase
- Some of the cultivars are showing clear signs of susceptibility to diseases and pest.

B) Sweet Potato Programme

1. **Development of high yielding consumer accepted varieties**

Introduction

Sweet potato is increasingly becoming an important root staple; and has enormous potential to be used as a staple and cash crop for the numerous food insecure and poverty stricken households, livestock industry, and for industrial use and export in Ghana and the sub-region. The expanded use of the orange-fleshed sweet potato (which contain high amounts of beta-carotene, precursor for vitamin A) in food-based nutritional programmes can significantly serve as an inexpensive affordable source for combating vitamin-A deficiency.

The development of (or improvement) of specific varieties to meet specific end uses in Ghana and the sub-region has the potential of transforming the crop's

production, its use, its market potential, its consumption, and its health benefits through a significant diversification in product forms and better integration into smallholder farming systems. Therefore, there is the need to develop varieties for specific end-use that are acceptable by farmers, consumers and agro-industrialists. These are high yielding, resistant to pests and diseases and good for food and industrial products as well as of high nutritive value (high beta-carotene, protein etc.).

Objectives

- Develop high yielding, disease and pest resistant sweet potato varieties with improved quality in terms of consumer acceptance, processing and nutritional value (high beta-carotene, starch and dry matter contents).

Activities

- Collection and characterization of local and exotic germplasm
- Evaluation, conservation and selection of desirable genotypes for genetic improvement
- Hybridization of parental clones by introgression of desirable genes into adapted germplasm using conventional and marker assisted selection (MAS).
- Multi- locational testing of promising genotypes to generate new varieties

Results

- Back-up field of the germplasm established at the CSIR-CRI outstation at Pokuase where the SPVD pressure is low was maintained.
- Molecular characterization of these accessions at the molecular biology laboratory at CSIR-CRI is in progress.
- Root characteristics of the eighty seven (87) accessions (due to some germplasm losses) of the germplasm planted at Fumesua have 64% having long curve or elliptic and 20% having round or round elliptic shape, 74% having intermediate to thick cortex thickness, with predominant skin colours of yellow (31%), cream (27%), and dark purple (1%). For root flesh colour, 19% of the accessions are orange-fleshed, 27% have yellow flesh, while 54% are white/cream fleshed. Sensory evaluation carried out shows sugar level composition of the accessions as 50% high sugar level, 35% medium sugar level and 15% low sugar level respectively. Laboratory determination of sugar content of the accessions is on-going to confirm

the sensory evaluation results. Current population development priorities are on developing (i) orange-fleshed (ii) white/yellow-fleshed and (iii) low/ non-sugary populations. This implies that about 20% and 15% of current germbank accessions are orange-fleshed and low sugar level respectively from which selections can be made for the breeding work. The harvest index results also indicate that 34% of the accessions have over 50% sink capacity, which is a good attribute for photosynthate accumulation into root bulking.

- The crossing block was established in early June. The major traits targeted still remain as high root yield with dry matter, high beta carotene content and tolerance to SPVD, sweet potato weevils and millipedes, non-sweet or less sugary, early maturing/bulking and high starch and flour. Controlled or specific crosses were not carried out due to severe drought over the period affecting flowering. However, the few polycrosses or open-pollinated seeds are yet to be controlled or harvested from the crossing block.
- Harvesting of sweet potato variety trials with nine (9) entries (including 2 local checks) established at Fumesua, Ejura Pokuase and Ohawu for adaptability and acceptability trials during the second half of year 2009, has begun at Femesua.
- At least two varieties from sweet potato variety trials are candidates for propose release in 2010.
- Harvesting of second year mega-clone adaptability and acceptability trial planted between June and August 2009 at Fumesua, Ejura, Pokuase and Ohawu has been done.

2. Production and distribution of healthy planting materials

Introduction

Efficient and functioning seed systems are required to ensure adoption of new varieties. The unavailability of clean planting material has been cited as one of the most important limiting factors in developing sweet potato crop. The availability of sufficient and timely planting materials for farmers is a key element for ensuring productivity. The multiplication of vegetatively propagated crops such as sweet potato through conventional multiplication rates for vines (15:1) has always presented a challenge compared to most cereal crops200-300:1). However, various rapid multiplication techniques are being developed (attaining rates of 90:1) and a constantly being improved to improve adoption and crop

productivity. Therefore, the timely provision of planting material of appropriate quality (healthy) and efficient dissemination for smallholders has been a great concern to increase sweet potato production and provides a key opportunity to poverty alleviation. The healthy (clean) seed material a farmer begins with significantly influences the yield obtained.

Objectives

- To produce and supply healthy planting materials (i.e. the basic or breeder seed material) of released varieties to seed industry
- Improve vine conservation and multiplication methods. Build on current farmer practices and evaluate promising robust, cost-effective methods or techniques of conserving and multiplying planting materials on large scale
- Train farmers in these techniques

Activities

- Produce and supply healthy planning materials of released varieties to seed industry
- Establish appropriate and rapid multiplication techniques verified for low inputs cost
- Evaluate cost-effective methods or techniques of conserving and multiplying planting materials on large scale
- Establish community-based, sustainable seed production and distribution systems operating in targeted countries
- Train farmers in rapid seed multiplication and conservation/storage techniques

Results

- Half acre of primary multiplication of the eight released varieties is to be multiplied at Fumesua in December 2009 amd primary materials given to the Root and Tuber Improvement and Marketing Programme (RTIMP) for multiplication at irrigation sites during the dry season. Some strategies being adopted to supply healthy materials for further multiplication and distribution to farmers include multiplication and maintenance at irrigation sites, use secondary multipliers of RTIMP and establish community-based sustainable seed production and distribution system.

- The Biotechnology team is developing in-vitro production guidelines for rapid multiplication of clean materials. In-vitro initiation of the varieties has been carried out.

C) Yam Programme

1. Farmer participatory breeding of yams in three agroecologies

Introduction

The existing yam varieties in Ghana yield far below their potential (10 t/ha as compared to potential yield of over 60 t/ha). There are only 3 new varieties released with yield potential 45-70t/ha. These varieties are yet to be massively multiplied and disseminated. The urgent need to research and develop more improved varieties to increase the diversity of the improved yam varieties pool cannot be over-emphasized.

Objectives

Over a five-year period, to develop at least three high and stable- yielding yam varieties, with pest and disease tolerance and good cooking qualities with farmer participation in Ghana.

Methodology

A 5-year study in 2 communities each in 3 agroecologies: Coastal savannah (Bodwease and Bontrase), Forest (Boamadumase and Ejisu), Forest-savannah transition (Ejura and Kintampo). The best genotype put up for on-farm evaluation and subsequent release in the third year onwards.

In 2009, trials were established in 3 communities in 3 agroecologies: Bodwease, Fumesua and Ejura (to be expanded to 6 in subsequent years). Participatory varietal selection trials involving 9 *D. cayenensis* and 5 *D. alata* were established at the 3 listed locations using RCBD in 3 replications.
A total of 4 farmer field days have been conducted in 2009, where farmers assessed the plants at vegetative stage scoring for the vegetative characters such as vine thickness, canopy formation, and leaf characteristics as well as pest and disease tolerance.

2. Promotion of use of minisetts from mother seed yams of Dioscorea rotunda as rapid method for propagation

Introduction

Planting material cost and availability is known to be a major constraint in rapid expansion of yam cultivation in general. The minisett technique which was touted as the panacea for this problem experienced low adoption due to several reasons, amongst them the non-responsiveness of the most preferred varieties such as *Pona* and *Laribako* to the technique, and the relatively long period of generating seed yam compared to the traditional seed system of pricking to obtain seed yams.

Even though the superiority of this system over the traditional double harvesting system has been proven by several researchers and the system has been adopted in certain parts of Nigeria, farmers in Ghana have not. Several reasons have been attributed to this. Among them are poor sprouting and establishment of some elite yam cultivars like *Pona* and *Laribako* when multiplied by this method. Long time lag between seed yam generation and availability for planting. The generally poor understanding of the technique at the time of its introduction by major stakeholders such as farmers and extension agents who were to impact such knowledge to farmers.

Objectives

- To reintroduce minisetts to yam farmers taking into consideration recent development in the technology.
- To use minisett technique as a rapid means of generating seed yams of the three released varieties for dissemination to farmers.
- To train farmers in the use of alternative seed yam multiplication systems i.e. vines multiplication of yams.

Methodology

The study involves the establishment of farmer-led participatory communal farms in six villages (two each in coastal, forest and forest-savannah transition agroecologies). Year one involved sitting communal farms at the selected villages. Farmers would be selected from farmer groups from neighbouring centre where the communal farm is situated.
Each participating farmer will have a share of the produce after year one to set up communal farms in his/her village to cater for different set of farmers. Year three would involve massive multiplication in all sites having the genotypes.

Also to enhance vegetative growth and increase the efficiency of vine multiplication, foliar application of NPK was completed at Bodease, Ejura and Fumesua in July 2009.

A trial was then set up to assess the establishment medium for vine multiplication with farmer participation in July 2009 at Fumesua. Two sprouting media (soil and carbonized rice husk) were assessed using RCBD with three replications. Each plot had 40 vines directly planted after excising them from the main plant. Data has been taken on establishment, rate of sprouting and pest and disease incidence and severity. Harvesting is tentatively scheduled in January 2010.

3. Participatory Evaluation and Selection (on-station) of *D. rotunda* and *D. alata*

Objective

Over a five-year period, develop five high and stable yielding yam varieties of *D. rotunda* and *D. alata* for on-farm evaluation and release in Ghana.

Methodology

The study involves five-year study in two communities each in three agroecologies; Coastal savannah (Bodwease and Bontrase), Forest (Boamadumase and Ejisu), Forest-savannah transition (Ejura and Kintampo).

Activities

- Forty lines each of Brass and Dente were planted at Bodwease, Fumesua and Ejura using augmented RCBD, aimed at developing superior lines of Brass and Dente.
- Farmer field day was conducted in July 2009 at the full canopy formation stage
- Data was collected on pest and disease incidence and severity at all locations between July and November
- Harvesting has been completed at Bodwease and data yet to be analyzed. However, initial response from farmers at the field level during harvesting indicates that two each of the lines of Brass and Dente were the most preferred varieties.
- Harvesting at Fumesua and Ejura is scheduled to be conducted in January 2010.

Yam Agronomy

Objectives

- To determine the rate of poultry manure/cow dung application either alone or in integration with chemical fertilizer for high and profitable yields of yam

- To compare cover crop fallow with farmers' practice of natural fallow as preceding fallow management systems in the improvement of soil chemical and physical properties, on weeds, diseases, pests and yam yield.
- To investigate the agronomic and economic feasibility of not staking yam
- To develop suitable intercrop systems for yam
- To investigate the economic benefits and environmental implications of technologies being developed.

Activities

- 120 seed yams of non-staked variety TDr 89/19177 received from IITA in October 2009 for further multiplication
- Farmer field day held at Fumesua in August 2009
- Harvesting of the trial scheduled for December 2009.
- Farmer field day held on integrated weed and soil fertility management with legume intercrops in sustainable yam production. Data harvested cowpea was taken. These included total pod weight, total shelled weight, 100 shelled weight and 100 seed weight. Data is yet to be analyzed.

Study II: Mechanization-Ridging as a mechanized alternative to mounding for yam production

Objectives

- To quantify the effect of manual ridging and mounding on the yield, tuber shape and other agronomic characteristics of yam by the end of year five
- To develop and disseminate a mechanized system of seed bed preparation for yam through ridging by end of year five
- To determine the interactions between seed bed preparation and fertilizer application on yam yield and agronomic characters by end of year five.

Activities

- Field evaluation with farmers of the manual and mechanized land preparation method carried out
- Quantification of land preparation effect on tuber yield, shape and other agronomic characteristics
- Determination of interactions between seed bed preparation and fertilizer application on yam yield and agronomic characters
- Farmer field day conducted

Data collected on activities

- Number of plants harvested
- Number and weights of marketable tubers
- Number and weights of unmarketable tubers
- Number and weights of seed tubers
- Fresh and dry sample weights
- Number of plants with nematodes damage and their scores
- The length, circumference and diameter of the tubers

Data is yet to be analyzed and trials at Ejura will be harvested in December 2009.

D) Cocoyam Programme

INCREASED PRODUCTIVITY, VALUE ADDITION AND UTILIZATION OF COCOYAM THROUGH CROP IMPROVEMENT IN GHANA AND SUB-SAHARAN SUB-REGION

Objectives

To produce high yielding, disease tolerant/resistant cultivars of cocoyam acceptable to end users

- To broaden the genetic base of cocoyam

Introduction

Cocoyam provides energy for over 3000 million people worldwide, especially in the tropics and sub-tropics. The estimated per capita consumption in Ghana is about 54kg/hd/yr which is second to cassava within the root and Tuber crops (PPMED). World average production is about 8.8mt/ha(FAOSTAT),however average yield in Ghana is between 6.0-6.5mt/ha. Lower yields in Ghana are attributed to no improved variety in the system. Other contributing factors include disease prevalence, declining fallow period and indiscriminate use of herbicides.

Activities

Vegetative characterization of 800 accessions of cocoyam collected from the major cocoyam growing areas in Ghana was carried out using the International Board for Plant Genetic Resources (IBPGR, 1989) Cocoyam Descriptor. The following attributes were used : Growth habit, plant height petiole attachment, lamina orientation, leaf shape, leaf margin colour leaf sinus denudation, glossiness of leaf surface, colour of upper leaf surface, colour of lower leaf surface, leaf variegation, leaf pubescence, petiole sheath. The accessions were

classified into 2 distinct phenotypic group –Red 95.4% and White 4.6%.Further characterization of the cormels will be done at harvesting time. Molecular characterization is being carried out by the Biotechnology outfit to complement the vegetative.
The callous materials of 3 clones (SW 011, SCJ98/029 and Rax93/008) were irradiated at the following dosage 0{control), 5gy, 10gy, 15gy and 20gy respectively. The irradiated materials are in-vitro.
Disease and vegetative data (plant height, petiole length, petiole sheath length, leaf area, number of leaves and base circumference) were taken at the respective sites.
Regular monitoring was carried out ensure the proper upkeep of the fields.

E) Biotechnology

Some biotechnology activities carried out during the period under review include:

A) Establishment of *in vitro* Production Guidelines and protocols development for root and tuber crops

Introduction

The use of biotechnology techniques for the enhanced agriculture production is a tool that has been used efficiently in the developed countries. Micropropagation ensures the production of clean planting materials with high crop yield. The use of clean planting materials for distribution to farmers and researchers fields deals with the risk of distribution pathogens through the use of infected planting materials. It is also indicated in the literature that the use of clean planting materials can lead to about 30% increase in sweet potato tubers.

Although the use of tissue culture techniques has been employed for the past decade, the tissue culture production trends are not documented. This information is vital for farmers and researchers using “clean” tissue produced planting materials. The establishment of production guidelines will provide information on how much plantlets can be produced within which period. The appropriate medium to be used for each variety can also be established since they respond differently to a particular culture medium.

Objectives:

Develop *in vitro* production guide lines for rapid multiplication of clean planting materials

Optimize *in vitro* production processes for the various varieties of local root and tuber crops.

Goal	Activity
1. Production, distribution, and conservation of healthy planting material: Establishment of *in vitro* Production Guidelines and development of somatic embryogenesis protocols for Cassava, Sweet potato, Yam and Cocoyam	1.1 *In vitro* meristem and nodal cutting initiation protocols optimization for the various root and tuber crops 1.2 Use meristem and heat therapy techniques to clean at least 3 released varieties 1.3 Multiplication and rooting media optimization for the various root and tuber crops 1.4 Sub-culturing of plantlets 1.5 Hardening of plantlets 1.6 Data collection and analysis

Results

Cultures initiated during the first half year have been sub-cultured to monitor the *in vitro* growth rate. The tables below indicate cultures presently under incubation.

Cocoyam elite varieties in culture-Initiated from meristem

Variety	Total number of initiated in culture	Numbers presently in culture
BD 96/183 (1)	6	8
AGA 97/162 (2)	3	12
SW 011 (3)	2	3
FC 006/F1 (6)	3	6
ADE 011 (7)	3	4
SCJ 98/009 (8)	3	4
RAX 93/008 (9)	3	7
ABN 01/004 (4)	4	8

The cocoyam cultures are due for the next subculture where the numbers will start increasing exponentially. The data above depicts the slow rate of development of the cultures initiated from meristem. A set back in the production of meristem technique in the laboratory is the lack of appropriate equipment to train personnel adequately in the excision of meristems.

Sweet potato in culture

Released varieties	Number initiated	Number after first subculture	Number presently in culture
Otoo	8	18	30
Faara	4	36	90
Apomuden	6	34	373
Hi-starch	17	65	310
Sauti	14	33	60
Elite varieties	Number initiated	Number after first subculture	Number presently in culture
Zapallo	4	12	30
Beauregard	6	27	350
Resisto	6	18	34
Naveto	8	12	15

Yam culture-initiated in July 2009

Variety	Number initiated	Number in culture after rescue	Total number in culture
Mankrong Pona	10	36	55
CRI Pona	24	32	114
Kurapa	8	27	65

B) Increased Productivity, value addition and utilization of Cocoyams (*Xanthosoma and Colocasia* Specie)

Objectives

Breed for broad genetic base to facilitate selection and meet various end-user needs

Goal	Activity
5 Cocoyam crop improvement (varietal development and release): Increased productivity, value addition and utilization of cocoyams (*xanthosoma* and *colocasia* Specie) through crop improvement in Ghana and sub-Saharan Sub-region cocoyams	*5.2* Molecular characterization of *Colocasia* 5.3 Molecular characterization of *xanthosoma* 5.4 *In vitro* establishment and multiplication of elite *Xanthosoma* *5.5* *In vitro* conservation of elite *Xanthosoma* 5.6 Initiate induction of somaclonal variation 5.7 Induced mutation 5.8 Irradiation of clones using gamma radiation

Results

Laboratory supplies were obtained from a supplier in South Africa and will be used for the evaluation of appropriate conservation medium for the elite varieties. To broaden the genetic base of the cocoyam germplasm, three of the nine elite varieties have been subjected to gamma radiation as presented in the table.

Variety	Dose of Radiation (GY)	Quantity Radiated Large test tubes	Quantity in culture Number of jars
SW 011	0	10	10
SW 011	5	10	13
SW 011	10	10	8
SW 011	15	10	14
SW 011	20	10	9
SCJ 98/009	0	10	10
SCJ 98/009	5	10	7
SCJ 98/009	10	10	15
SCJ 98/009	15	10	11
SCJ 98/009	20	10	13
RAX 93/008	0	10	10
RAX 93/008	5	10	8
RAX 93/008	10	10	10
RAX 93/008	15	10	12
RAX 93/008	20	10	9

Each jar had 5-8 explants

Radiated cultures have been cultured in baby food jars using the regular cocoyam multiplication medium, to monitor growth and development.

F) Socio-economic studies

Goal

The main goal of socioeconomics is to assist in making research more responsive to the needs and aspirations of farmers and other players in the root and tuber crops value chain and to provide feedback information to the system. The socioeconomics component of the WAAPP undertook a number of studies during the period under review. Some of these include:

A) Cost and profitability analysis of cocoyam production

Introduction

Cocoyam is a staple food for many people in developing countries in Africa, Asia and the pacific (Agueguia *et al*, 1992). Cocoyam is one of the major starchy

staples produced in Ghana. Major centres of production in Ghana are the forest and transition agro-ecological zones in the country. Cocoyam ranks first in Ghana, second in Cameroun and third in Nigeria as the most valuable root crop.(Knipscheer and Wilson, 2000) and Echebiri, (2004).
Nutritionally, cocoyam is superior to cassava and yam in the possession of higher protein, minerals and vitamin contents in addition to having a more digestible starch (Parkinson, 1984; Splitoesser *et al* 1973).

In spite of the many potentials of cocoyam production, the crop is still treated as a minor and research and development in exploring greater potentials of the crop is still primary.
Farmers are usually faced with combinations of inputs that would yield maximum output and maximize their welfare. They therefore want to select a venture that would minimize their cost of the production and maximize their profit. With the diversify nature of the crop, yield alone is not the prime objective of farmers but rather the income generated through the sale of crop materials.

Objectives

The objectives of the study were:

- Estimate the total cost for producing a hectare of cocoyam
- Estimate the total revenue derived from a hectare of cocoyam
- Estimate the net returns from a hectare of cocoyam
- Make recommendations based on findings

Methodology

Participatory Rural Appraisal (PRA) Technique was adopted for the study. Key informants as well as focus group discussions were used. Farmers interviewed were basically cocoyam producers and were made up of males and females but in most cases males were dominating.
Information was elicited from cocoyam producers in both the forest and transition zones of the country. These zones were selected because they constitute the cocoyam growing areas. The survey covered Ashanti and Brong Ahafo Regions. In all, ten districts were covered; six in the Ashanti Region and four in the Brong Ahafo Region.
A total sample of one hundred and seventeen (117) farmers was interviewed from thirteen (13) villages.

Data Analysis

The data was analyzed using descriptive statistics and the cost and return procedure on per hectare basis. The format of the cost and return used in the analysis was employed from a study carried out by Okoye *et al*, 2006.
Since it was a PRA, the descriptive was presented as a summary statistics of the various variables used in the cost and return estimation. Data such as resource allocation which includes amount of labour used for each activity, other variable inputs like cocoyam setts, weedicides, pesticides, sacks, black polythene bag, cost items as well as output (yield) and output prices were elicited from the farmers. The descriptive statistics such as mean, maximum minimum and standard deviation were used to discuss the data or information drawn from farmers. Data on farmers activities in cocoyam production, inputs used, prices and yields per hectare basis were obtained from farmers.

Results

Out of the 117 farmers met, 81 (69%) were males and 36 (31%) were females. The planting materials used are the corms setts but the study also revealed that small percentage of farmers used volunteers and for a hectare of land a farmer may use 7.5 bags of corms. If intercropped with yam, each mound has a corm sett. Cocoyam serves the farmers as food and cash crop.
Chemical inputs are seldom used in cocoyam production. Farmers only apply weedicides after land clearing to burn the weeds that remain after clearing. None of the farmers interviewed applied fertilizer to cocoyam.

Net Returns per Hectare of cocoyam

Item	**Value (quantity x unit price**	**Total (GHc)**
Quantity harvested in bags	32.71	32.71
Price per bag	32.11	32.11
Total Revenue	1050.32	**1050.32**
Variable Costs		
(A) Inputs Costs		
Weedicides	26.60	26.60
Planting material	103.33	103.33
Sacks	19.29	19.29
Black rubber	1.77	1.77
Pesticides	0.00	0.00
Treatment	0.00	0.00
Market taxes	2.15	2.15

Total		**153.14**
(B) Labour inputs		
Land preparation	100.28	100.28
Planting	48.89	48.89
Spraying	4.93	4.93
Weeding after planting	86.81	86.81
Harvesting	78.47	78.47
Loading fee	26.94	26.94
Transportation	29.44	29.44
Space for storage	2.78	2.78
Total		**378.54**
(C) Total Variable Cost (TVC)= A+B		**531.68**
Gross Margin (GM)= TR-TVC		518.64
Fixed Cost		
Land acquisition	98.61	98.61
Total Cost (TC) TVC+TFC		**630.29**
Net Returns (NR) =TR-TC		**420.03**
Benefit Cost Ratio (BCR) =TR/TC		**1.67:1.00**

Source: Survey data 2009

The cocoyam enterprise was analyzed and the results in table above show that the enterprise is profitable with farmers making forty per cent (40%) returns on the total money invested although the output from the farmers were far too low compared with that of other countries such as Nigeria. The average revenue generated from production was GHc1050.32 while that variable cost of production was GHc531.68. The total cost involved in cocoyam production was GHc630.29 with labour inputs alone constituting about seventy-one per cent (71%) of the total variable cost of production.
This makes labour the key component of cocoyam production.
Conclusion

In conclusion, cocoyam production in Ghana can be said to be a profitable enterprise despite the low yields and high labour cost. It is labour intensive and most of the operations are carried out manually using traditional methods of production. The crop is a potential food security crop and if farmers would devote their attention and allocate the needed resources to its production; they stand to gain a lot in terms of income and also its nutritive value.
Research must be intensified in developing improved technologies in its production so as to cut down on the high cost of labour.

REDUCING POST HARVEST LOSSES IN YAM (*Dioscorea* spp)

OBJECTIVES:

- To study yam post harvest handling and storage practices at farm, wholesale and retailer levels
- To find applicable solutions to identified problems and develop short- and long-term strategies to address key issues throughout the value chain

Activity 1.1 Assessment of *in vitro* anti-fungal activity of botanical extracts against yam rot organisms

Objectives:

- To determine the presence or absence of anti-fungal activity in selected botanical materials
- To select materials with the highest activity against yam spoilage fungi

Methodology: Materials used were:

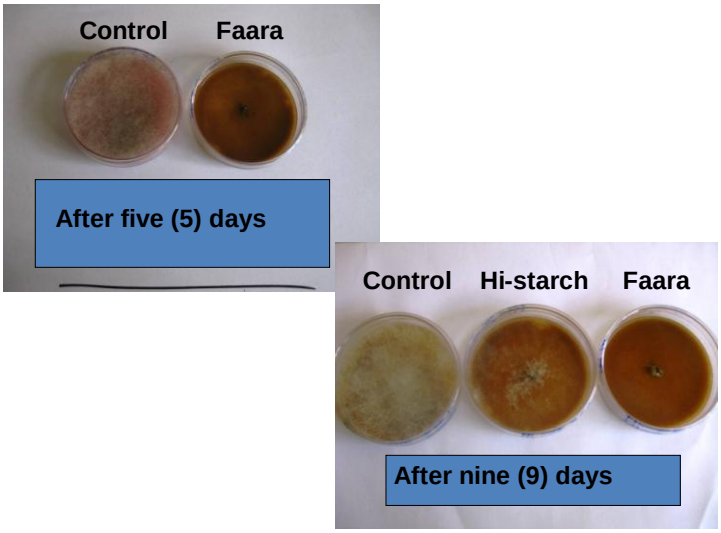
1. Dried peels of sweet potato (*Ipomoea batatas*)
   4 released varieties (Sauti, Faara, Hi-starch, and Otoo)
   1 elite clone (Humbachero)
2. Dried pawpaw (*Carica papaya*) seeds

Both Ethanolic and Aqueous extracts were prepared from the test materials in different concentrations and mixed with Potato Dextrose Agar in a ratio of 1:1 and plated under sterile conditions. The plates were infected with mixed cultures of fungi obtained from infected yam, incubated at room temperature and assessed every 24 hours. The experiment was terminated after 13 days

Results:

- Aqueous (water) extraction was selected in order to cut down costs since it showed comparable effectiveness with ethanol extracts

- Faara peel extract showed total inhibition of *in vitro* growth of the yam spoilage fungi even after 13 days in culture
- Extracts from peels of Hi-starch and Humbachero, as well as pawpaw seeds showed appreciable levels of inhibition
- Sauti and Otoo extracts appeared to have no inhibitory effect on the fungi
- Based on these preliminary results Faara, Hi-starch and pawpaw seeds were
  selected for further studies.



ACTIVITY 1.2 Yam storage study: *In vivo* anti-fungal efficiency of selected botanical extracts against storage rot

Objectives:

- To test the efficacy of direct application of anti-fungal botanical extracts to yam tubers in a controlled storage experiment

- To select the best treatment for a wider storage setup




Methodology

Yams (Pona variety) purchased directly from a farmer at Kintampo were brought on-station and a storage setup was done within 4 days of harvest.

Treatments: Gum Arabic 30% solution
Gum Arabic + Botanical extract
Botanical extract only
Control

Experimental design: 8 treatments x 3 reps
Completely Randomized Design

Selected botanical extracts:

1. Powdered dry peels of sweet potato varieties Faara and Hi-starch

2. Powdered sun-dried pawpaw seeds

Status: On-going

Concluding statements

Deterioration in yam is progressive. It can start very small in a tuber and may appear to be insignificant for a while, but eventually losses can be massive. Full-blown deterioration often occurs in the hands of the last buyer and therefore many farmers tend to believe that their post-harvest handling practices are adequate. Invariably, the costs/losses involved are at the expense of the last buyer. Timing of the main harvest to coincide with cool weather, and periodically removing sprouts from the tubers during storage are very good farmer practices but these are still inadequate.

Factors affecting yams in storage

Although the provision of improved storage structures may help, other vital issues need to be addressed in managing the problem sustainably.

1. Health of planting material directly determines the health of the mature tuber
2. Injury of tubers during harvesting affects their storage characteristics and is usually minimal in small sized tubers which are easier to handle
3. Farmers plant only once in a year (beginning of the year, during cool weather) and attempt to store for several months (up to the middle of the year)

Recommended strategies

Multi-disciplinary research required to develop and promote long-term solutions to post-harvest deterioration in yam (5 years)

1 Promote the use of healthy and affordable planting materials to replace the 'milking' practice to eliminate the transmission of inherent pathogens (e.g. nematodes, fungi) from crop to crop.
2 Avoid injury during harvesting and transportation by reducing tuber sizes through the use of small sized seed yams
3 Reduce length of storage time by encouraging minor season planting (increase the availability of affordable healthy planting materials)
4 Develop affordable improved storage structures at the farm, rural market and city market levels
5 Develop other environmentally friendly measures to reduce fungal attack on yams in storage, e.g. the use of botanical extracts with anti-fungal activity

2.0 POST HARVEST SCREENING OF SWEETPOTATO GERMPLASM: physico-chemical characterization and product development

Activity 2.1 Value addition through product development using different clones for recommendations to Sweet potato Improvement program

BACKGROUND

Sweet potato (*Ipomoea batatas*) is known to be more nutritious than most other starchy staples. Although it is cherished in many parts of Asia, the Pacific and parts of the US, here in Africa it still carries the wrong image, being known as the 'poor man's food'. China is the world's largest sweet potato producer (80 % of the world's annual production), and a large proportion of their output goes into industrial applications. Sweet potato is a very versatile crop which can fit into a wide range of domestic and industrial applications. It has an impressive profile of nutrients and other health-giving compounds including vitamins, minerals, beta-carotene, flavonoids, phenolic acids and other potent anti-oxidants, and in Japan and Australia some varieties are commercially used for therapeutic purposes. In Ghana some coastal communities and a few areas in the North are known to grow and eat sweet potato as a snack food or as a famine reserve and is limited to boiling, roasting or frying. Current research on product development and value addition has implications in Ghana's School Feeding Programs as well as the food-based approach to Vitamin A deficiency alleviation using high beta-carotene sweet potato varieties.

Staple food preparations from sweetpotato

Innovative sweetpotato products from CRI

Sweetpotato Breakfast mix

- Healthy for both children and adults
- Quick-cooking, high beta-carotene; pregelatinized

Sweetpotato's potential in the Ghanaian food industry

Important attributes of genotypes for different products

PRODUCT	High Starch	Intense colour	High sweetness	Intense flavour
Breakfast mix	+	+	+	+
Fufu	+	-	-	-
Ampesi	-	-	-	-
Gari	+	-	-	-
Beverage	-	+	+	+
Yoghurt	-	-	+	+
Flour	+	-	-	-
French fries	+	-	-	-
Crispy chips	-	+	+	+
'Eto'	+	+	+	-
Banku	+	-	-	-

Constraints/Problems encountered

- Expected laboratory equipment still not received in 2009
- Product development and food processing laboratory facilities required

Activity 2.2 Determination of specific gravity and sugar contents of available Clones/accessions (87)

Status: On-going

3.0 DEVELOPMENT OF GREEN LEAFY VEGETABLES FROM ROOT CROPS FOR BETTER NUTRITION AND INCOME

Activity 3.1 Development of sweet potato (*Ipomoea batatas*) leaves as a green leafy vegetable

Background

Sweet potato leaves are known to be more nutritious than many other green leafy vegetables, being a significant source of lutein (good for eyesight), phenolic compounds (anti-oxidants), minerals, vitamins and protein. Low patronage of

sweet potato leaves as a leafy vegetable at the domestic level is due to unpalatability of some genotypes and insufficient knowledge about preparation methods.

Preliminary results

Initial screening of available clones revealed six (6) genotypes with promising leaf palatability. These are: Wagabolige, Brondal, Hitor Asiaton, DAAK 05/005, Okumkom
and Humbachero. In the next phase of this study, sweet potato leaves from selected genotypes will be used to prepare stir fried leaves, 'palava sauce' and cooked mash with palm oil. These will each be subjected to consumer acceptability testing.

Activity 3.2 Preservation of cocoyam (*Xanthosoma* sp) leaves *('Kontomire')* for year-round availability

Background

Kontomire, arguably Ghana's most popular green leafy vegetable, is also a good source of many vitamins, minerals and some amount of protein. Though cherished by both the poor and the affluent for its good taste, it has a very short shelf life with limited preservation options. In industrialized countries, similar leafy vegetables like spinach are stored frozen. Unfortunately frozen raw *kontomire* has poor palatability. However preliminary research so far indicates that processing prior to storage seems to help maintain its palatability.

Objectives:

- Find the effect of different pre-storage treatment methods on the palatability of minimally-processed frozen cocoyam leaves
- Determine varietal differences in storability of cocoyam leaves
- Promote the sale of processed frozen kontomire through local cold store outlets

Status: Preliminary work initiated

4.3 Component Three: Funding of demand-driven technology generation and adoption

The objective of the component is to strengthen more priority-focused, transparent funding mechanism for demand-driven agricultural R&D on the

country's priority commodity. Furthermore, the project will support the transfer of on-the-shelf agricultural technologies with potential for quick impact.

Through the Research Extension Linkage Committees (RELC) the Competitive Agricultural Research Grant Scheme Board (CARGS) and the World Bank approved eight (8) competitive research projects for funding. The project areas include agronomic practices, disease and pest management and post-harvest problems. The CARGS BOARD also approved eight (8) non-competitive research disciplines for funding.

Component Four: Project Coordination, Management, Monitoring and Evaluation

This component aims at establishing an effective coordination, management and M&E system at the national level.
The mandate of this component include

- Day-to-day management of project
- Organizing Project Steering Committee Meetings
- Monitoring and Evaluation of project
- Procurement of goods and services
- The disbursement of funds to programme implementing agencies

Project Steering Committee Meetings

During the period under review two project steering committee meetings were held to give technical policy direction of the project.
The first meeting was held on the 18th March 2009. The meeting comprised representatives of the implementing agencies, MDAs, farmers and processors. Members reviewed the status of programme implementation and made recommendations for the achievement of project objectives.
The second Project Steering Committee meeting was held from 23rd to 25th of September 2009 in Kumasi. Members reviewed the achievements so far made and approved the 2010 annual work plan and budget prior to the Regional Steering Committee (RSC) held in Ghana in October 2009.

Regional Steering Committee

Ghana hosted the second Regional Steering Committee (RSC) meeting from 26th to 30th October 2009. The objectives of the meeting included;

- Discussion and review the extent of project implementation;
- Discuss the indicators of the project and their follow-up;

- Examination of the work plan and budget for 2010 and procurement issues for approval;
- Validation of the baseline-studies reports of the three participating countries
- Undertake field visit to research stations and on-farm stations
- Discussion of any other important issues related to the implementation of the project.

Results of the Meeting

The following were achieved at the end of the meeting;

- Discussions and adoption of the way forward for project implementation;
- Discussion and approval of annual work plans and budgets for 2010;
- Discussion and adoption of project indicators
- Validation of baseline report of Ghana;
- Field visits to research stations and on-farms.

WAAPP Stakeholders Meeting

As recommended by the first ISM, a workshop to bring together various stakeholders involved in WAAPP in the sub-region was held in Accra on 24th March in Accra. The meeting also brought together other stakeholders of the participating countries of WAAPP (Mali and Senegal) and officials from CORAF/WECARD, the official governing body of the project.

Objective of the Workshop

The objective of the workshop was to give participants and stakeholders an insight to measures to be taken to achieve the objectives of WAAPP and its implementation.

Participation

The meeting was attended by research scientists and officers from the Council for Scientific and Industrial Research (CSIR), representatives of the Ministry of Food and Agriculture (MOFA), farmers and Non-Governmental Organization. Other participants were representatives of Mali and Senegal and officials of CORAF/WECARD.

Programme Implementing Units Meeting

It aims at generating and disseminating improved technologies in the country's priority areas that are aligned with the region's top priorities. Programme

launching had taken place in all the three countries together with the regional launching.
In connection with WAAPP activities Ghana hosted CORAF/WECARD a meeting among the Country Implementation Units on 25th March 2009 at Coconut Grove Regency Hotel in Accra.

Objective of the Meeting
The objective of the meeting was to bring together staff of Programme Implementing Units to discuss and harmonize some issues of implementation as regards the individual country levels.

Participation
The meeting was attended by senior and management staff of the Programme Implementing Units (PIUs) of WAAPP from the participating countries, research scientists of the research institutes of the project and officers of CORAF/WECARD.

Monitoring and Evaluation Validation Workshop
The World Bank and its clients are in agreement that a well designed monitoring and evaluation (M&E) system is critical to the successful implementation of WAAPP, the unambiguous assessment of its impacts, and a systematic analysis of lessons learned. The M&E system of the WAAPP in Ghana will be a sub-set of the M&E System established by WECARD/CORAF.
From the recommendations of the First Regional Steering meeting in Dakar, Senegal, M&E Experts of the participating countries together with CORAF/WECARD met in Bamako, Mali to discuss M&E indicators of the project.
The outcome of the Bamako meeting proposed a validation workshop that would produce an M&E manual in Accra. The Accra meeting was held from 26 to 27 March 2009.

Workshop Objective

The workshop objectives as enumerated by CORAF/WECARD were:

- Examine the M&E implementation document prepared by a consultant for any amendments;
- Validation of the report

The consultant submitted a final draft of an M&E implementation Manual through CORAF/WECARD in June for operationalization.

Conduct of M&E Baseline Studies

To measure success at the end of project implementation, Ghana through a national consultant and the M&E Unit of the project conducted a baseline study in July 2009. The report was validated at the national level in September 2009.

M&E Activities

An efficient M&E system has been established together with all the necessary conditions and capacities required for the M&E outputs to make a valuable contribution to project decision-making and learning.

The M&E Unit also undertook regular visits to research stations and on-farm demonstration sites.

Training

Four officers of the Project Coordinating Unit (PCU) participated in short courses in Mbabane Swaziland in November 2009. This was to improve the skills and build the capacity of these officers to improve their job performance. The disciplines of training included; project management, financial management, computerized programme management and monitoring and evaluation of development and community projects.

Procurement Implementation Status

The procurement activities under the programme in 2009 progressed quite satisfactorily but not without some setbacks. The outlook for 2010 is promising as the programme hopes to improve on the current implementation status to finally conclude on outstanding issues as well as new procurements.

Goods and Equipment Category

Two contracts for the supply of vehicles with Messrs Auto Parts Ghana Limited: eight (8) units of 4WD Nissan Hardbody Double Cabin Pick-Up procured has being delivered and distributed to the implementing units and two (2) units of 4WD Nissan Patrol Cross Country Station Wagon is in the final stage of preparation for delivery.

Two contracts for the supply of office equipment and accessories with Messrs Perfect Business Systems: the supply of computer and office equipment and accessories (lots 1 and 2) is yet to be delivered due some delay in the establishment of the letter of credit. This hurdle has finally been cleared as a result of the inflow of adequate reimbursed funds from the Bank. Delivery is thus expected by the end of the first quarter of 2010.

The procurement of the laboratory equipment and supplies had multiple setbacks as two attempts to successfully carry out the procurement process failed due to the rather high evaluated bid amounts quoted as against the budgeted figure and secondly due to the non-compliance with the required mandatory procurement procedures which resulted in the cancellation of both processes. The process is currently being carried out again, this time with all the necessary concerns taken on board. Bids are due to be opened on 12 January 2010.

Consultancy Services Category

An external auditor, Messrs. AT-Ernst Dawlah, has been engaged January 2009 for a three year contract. The first year assignment was completed in June 2009 and the reported already submitted. The subsequent audit assignment will be carried when due.

The consultant for the pre- and post-contract consultancy services for the Design and Supervision of Construction of Biotechnology Laboratory Complex for the Crop Research Institute (CRI) of the Council for Scientific and Industrial Research (CSIR), Messrs Associated Beaver Consult, was recruited in July 2009 and has commenced the assignment of the design of the structure.

Civil Works Category

The bidding process for the Construction of Biotechnology Laboratory Complex for the Crop Research Institute of the Council for Scientific and Industrial Research is yet to commence as it is dependent on the design output of the consultant.

Due to the complexity of the structure to be put up the programme has agreed with the Bank that a pre-qualification of contractors be undertaken. The draft pre-qualification bid document has been reviewed by the consultant and will be forwarded to the Bank for clearance to commence the pre-qualification process.

Projections for 2010

- Completion of the delivery of the two (2) units of 4WD Nissan Patrol Cross Country Station Wagon;
- Completion of the delivery of computer and office equipment and accessories (lots 1 and 2);
- Evaluation, contract signing and delivery of laboratory equipment and supplies;
- Year two external audit assignment commences and concludes with report submission;

- Consultant's assignment for the Design and Supervision of Construction of Biotechnology Laboratory Complex continues;
- Prequalification of contractors for the Construction of Biotechnology Laboratory Complex commences and concludes with the selection of shortlisted contractors, and
- Construction of Biotechnology Laboratory Complex commences.

Strategies for the achievement of objectives

In achieving the objectives of WAAPP, a number of strategies were designed through good management practices for the attainment of success.

A communication strategy is being developed within the framework of MOFA to enhance the dissemination of technologies generated to farmers, producers agro-processors etc. This would indicate clear channels of communication.

Management has adopted the practice of regular management meetings and to apportion responsibilities to key members and hold them accountable.

An M&E Plan as required has been prepared as a monitoring tool to ensure the production of outputs and progress towards outcomes. Feedback and communication of M&E results and lessons learned are key M&E tools adopted to keep the interest of the implementation process, and to sustain the active participation.

At the operational level:

- Researchers and scientists are sensitizing different stakeholders on the attributes of new varieties and technologies.
- Establishment of demonstrations in more and different agro-ecologies
- Link up with other projects to multiply and disseminate the new varieties
- Multiplication and maintenance of primary planting materials at irrigation sites
- Establishment of community-based sustainable seed production and distribution system

Budget Implementation

The project has disbursed a total amount of US$ 2,040,245.98 out of a total project amount of US$ 15,000,000.00 representing about 14% of disbursement. The shows much improvement over year 2008.

Although the project had a waiver for 2008 account audit, Ghana has gone ahead to process the audit. The external audit report was ready at the end of June, 2009. (See attached as annex)

Constraints

Some constraints were encountered in the course of programme implementation. These were mostly at the research level. Some of them were:

- The procurement of the laboratory equipment and supplies had multiple setbacks as two attempts to successfully carry out the procurement process failed due to the rather high evaluated bid amounts quoted as against the budgeted figure and secondly due to the non-compliance with the required mandatory procurement procedures which resulted in the cancellation of both processes;
- Low/erratic rainfall during the first six months which affected crop growth both at on-station and on-farm;
- Limited technical training/support to undertake phenotypic and molecular characterization at the breeding level
- Maintenance of planting material during the long dry season period has been a challenge for most farmers, except those who have access to valley bottoms, utilized during the dry season

Main Recommendations

Some of the suggested recommendations identified include:

- The conduct of a study to investigate the sizes of setts and other planting materials used by Ghanaian yam farmers and to help introduce appropriate sizes of setts in an attempt to increase yield and profitability;
- Provision of irrigation facilities to irrigate conserved germplasm and crossing block, particularly during the dry season.
- Train technicians and support staff on crosses, phenotypic and molecular characterization;
- Identify more valley bottoms with residual moisture that can be used, where irrigation facilities are not available and the promotion of community-based seed system production approach.
- Technology generation, dissemination and adoption is a key challenge to the project and it needs to be addressed.

(Annex) DISBURSEMENTOF IDA FUNDS BY CATEGORIES BY DECEMBER 2009

DESCRIPTION	LOAN AMOUNT (US$)	TOTAL DISBURSEMENT FOR 2008 (US$)	FIRST QUARTER DISBURSEMENT (US$)	SECOND QUARTER DISBURSEMENT (US$)	THIRD QUARTER DISBURSEMENT (US$)	FOURTH QUARTER DISBURSEMENT (US$)	TOTAL (US$)
01. CIVIL WORKS	1,100,000.00		-	1,891.47	-	-	1,891.47
02. RESEARCH GRANTS	4,023,000.00			162,929.88	88,733.98	106,553.12	358,216.98
03. GOODS	2,270,000.00	15,536.83		2,832.51		328,108.56	346,477.90
04. TRAINING	1,761,000.00					48,825.55	48,825.55
05. CONSULTING SERVICES	612,000.00					9,809.00	9,809.00
06. OPERATING COSTS	2,834,000.00	627,899.40	270,007.53	29,959.33	102,437.28	217,578.24	1,275,025.08
07. SUPPORT TO CORAF/WECARD	1,000,000.00					-	
08. UNALLOCATED FUND	1,400,000.00					-	
TOTAL	**15,000,000.00**	**643,436.23**	**270,007.53**	**224,756.02**	**191,171.26**	**710,874.47**	**2,040,245.98**

DISBURSEMENT FROM IDA FUNDS BY COMPONENTS AS AT DECEMBER 2009

EXPENDITURE BY COMPONENTS (US$)	COST ESTIMATES (US$)	TOTAL DISBURSEMENT FOR 2008 (US$)	FIRST QUARTER DISBURSEMENT (US$)	SECOND QUARTER DISBURSEMENT (US$)	THIRD QUARTER DISBURSEMENT (US$)	FOURTH QUARTER DISBURSEMENT (US$)	TOTAL (US$)
Enabling Conditions for Regional Cooperation in Technology generation and dissemination	1,534,000.00	1,853.87	9,542.64	16,986.69	2,654.68	12,984.01	**44,022.69**
National Centre of Specialization (NCOS)	6,461,000.00	129,529.14	25,104.01	28,210.02	42,336.64	416,166.02	641,345.83
Funding of Demand-driven Technology Generation and adoption	4,387,000.00	396,677.67	177,062.32	146,464.44	77,062.51	184,247.55	981,514.49
Project Coordination, Management, Monitoring and Evaluation	1,118,000.00	115,375.55	58,298.56	33,095.34	69,117.43	97,476.09	373,362.97
TOTAL	**13,500,000.00**	**643,436.23**	**270,007.53**	**224,756.49**	**191,171.26**	**710,874.47**	**2,040,245.98**