12th TRIENNIAL SYMPOSIUM

INTERNATIONAL SOCIETY FOR TROPICAL ROOT CROPS - AFRICA BRANCH (ISTRC – AB)

September 30 – October 5, 2013

ALISA HOTEL, ACCRA, GHANA.

Theme

Competitiveness of Root Crops for Accelerating Africa's Economic Growth

Sub-themes:

- African Root Crops Trade and Market Scenarios
- Policies favourable to competitiveness of Root Crops in Africa
- African Scenarios on Production and Utilization of Root and Tuber Crops
- Business and Investment Scenarios on competitiveness of Root Crops in Africa-benchmarking Latin American, Asian and European Markets (Learning from Latin, Asian and European Industries)
- Mobilizing Investors for Sustainable Root and Tuber Crop Research and Development

RAPPORTEURS' REPORT

RAPPORTEURS

- **Prof. Kwame Afreh-Nuamah** - Rapporteur General
- **Dr. Joseph Nketiah Berchie** - Rapporteur
- **Mr. Felix Owusu Ababio** - "
- **Dr. Charles Tortoe** - "
- **Mr. Gregory Afra Komlaga** - "
- **Mr. Isaac S. Baning** - "
- **Mr. Isaac O. O. Ansah** - "
- **Mr. Kwadwo Adofo** - "
- **Mr. Joseph Adjebeng-Danquah** - "
- **Mr. John Lee Duncan** - "

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1.0 INTRODUCTION

This report highlights emerging issues from plenary/scientific presentations and discussions which followed.

Importance of Root and Tuber Crops in Africa

Agriculture is the mainstay of the African economy. Over 80% of the population derives their livelihood from subsistence agriculture. The challenges of overcoming poverty, food security, malnutrition and achieving sustainable management of natural resources in sub Saharan African are manifold.

Roots and tuber crops such as Sweet-potato, Cassava, Yams, Andean Roots and Tubers and Aroids provide great opportunities for long-term poverty alleviation and food security, much more than any other staple food produced in African.

Africa is the largest cassava and yam producing region in the world. However, 93% of these food crops are consumed as food, whereas in Latin America and Asia, less than half of what is produced is utilized for food consumption. This is because most food crop farmers are subsistence poor women who plant on marginal lands.

Nevertheless root and tuber crops are vital for both food security and income generation, especially for our poor rural farmers notably the women. Efforts by the private sector in general to commercialize these crops have been minimal and not quite effective. Consequently the competitiveness of African root and tuber manufactured products at the world market is very low.

The challenge has been how to commercialize and improve the competitiveness of root and tuber crop products in the market whilst still ensuring that the small-holder farmers who depend on these crops for their livelihood also benefit from it.

There is the need therefore for appropriate Research and Development (R&D) strategies to develop root and tuber crops into bastions of food security and income generation in Africa.

2.0 OPENING CEREMONY

The Opening ceremony was graced by the presence of the following personalities:

- Dr. Mohammed Alpha, Hon. Deputy Minister of Science Technology and Innovation (who represented H.E. The President of the Republic of Ghana)
- Prof. Keith Tomlins, President of ISTRC-World Branch
- Dr. Nzola Mahungu, President of ISTRC-African Branch
- Dr. A.B. Salifu, Director-General of CSIR, Ghana (who chaired the session)
- Dr. Ken Dashiele, Deputy Director-General of IITA, Nigeria
- Dr. Okonkwo, Director of National Root Crops Research Institute, Nigeria, who represented the Directors of the National Agricultural Research Institutes in Africa
- Dr. (Mrs.) R. E. M. Entsua-Mensah, Deputy Director-General of CSIR-Ghana and Chairperson of the Local Planning Committee.

2.1 Chairman's Remarks

The Chairman, Dr. A. B. Salifu, the Director-General of the Council for Scientific and Industrial Research (CSIR-Ghana) in his acceptance remarks indicated that the increase in human population was not corresponding with the increase in food production, and attributed this situation to the effect of climate change on food production. To offset this unfortunate situation, he called for the need of food production to increase by 40 % to meet the demand of the increasing population. He was convinced that root and tuber crops could be relied upon to offset the imbalance between food production and population growth. He was however worried about the competition between processing of food into biofuel in the midst of these challenges. He concluded that the theme for the symposium "Competitiveness of Root Crops for Accelerating Africa's Economic Growth" was very timely and relevant.

2.2 Summary of keynote address

In his keynote address, the Hon. Deputy Minister of Science, Technology and Innovation speaking on behalf of the President noted that despite the importance of root and tuber crops on the continent, its cultivation has been left in the hands of mostly smallholder farmers who plant on marginal lands using low technologies resulting in low productivity. He specifically cited the global food shortage between 2007-2008, which was also experienced in Ghana and challenged African scientists working on root and tuber crops to work hard and come out with technologies that will ensure that these crops secure the continent under such situations. He

further challenged African Scientists to create an enabling environment that will encourage farmers to strive towards commercial production of these crops.

This Conference was challenged to develop appropriate Research and Development (R&D) strategies to turn root and tuber crops to a major source of food security and income generation in Africa.

2.3 Goodwill Messages

Speaking on behalf of all Directors of NARS in Africa, Dr. Okonko, welcomed participants and indicated that the Society was very important to him, as a result he came with 30 participants from his own Institute.

Dr. Ken Dashiel, Deputy Director of IITA, was excited about the attendance and encouraged the participants to open-up to achieve their greatest expectations from the Symposium.

The World President of ISTRC remarked that Africa was very important for Root and Tuber crops and cited several projects he was leading including one which took partners from Ghana and Nigeria to Thailand and Vietnam to observe/understudy their cassava value chain system.

3.0 CONFERENCE STATISTICS

3.1 Participants

Country	**No. of Participants**	**Country**	**No. of Participants**
Benin	7	Liberia	2
Burkina Faso	2	Malawi	3
Burundi	1	Mozambique	1
Cameroun	1	Nigeria	81
Cote D'Ivoire	4	Sierra Leone	19
D.R. Congo	14	South Africa	1
Ethiopia	1	Tanzania	9
Ghana	45	Togo	1
Guinea	1	Uganda	11
India	1	United Kingdom	1
Kenya	3	U. S. of America	7
Total - 225			
Males	154	**Females**	71
No. of Institutions/Organizations represented - 50			
No. of Countries -22			

3.2 Papers presented by groups

CROP/ DISCIPLINE	AGRO NOMY	BREEDING	PROTEC TION	BIOTECH NOLOGY	PATHO LOGY	POST HARVEST	SOCIO ECONOMICS	TOTALS
CASSAVA	9	25	2	11	4	16	10	**77**
SWEET POTATO	2	2	0	0	0	4	3	**11**
YAM	1	4	0	1	1	4	0	**11**
COCOYAM	0	1	0	0	0	0	1	**2**
TARO	1	1	0	0	1	1	1	**5**
YAM BEAN	2	3	0	0	1	1	1	**8**
IRISH POTATO	0	0	0	0	1	0	1	**2**
FRAFRA POTATO (Solonesten on rotundi folius)	0	0	0	1	0	0	0	**1**
TUMERIC	1	1	0	0	0	0	0	**2**
GENERAL ROOTS AND TUBERS	2	1	0	1	0	1	1	**6**
SOIL	1	0	0	0	0	0	0	**1**
GENETIC RESOURCES	4	1	0	0	0	0	0	**5**
EQUIPMENT	0	0	0	0	0	1	0	**1**
TOTAL	**23**	**39**	**2**	**14**	**8**	**28**	**18**	**132**

3.3 Breakdown of participants by Institutions/Organizations

NO.	COUNTRY	NO. OF PARTICIPANTS	INSTITUTE/ORGANIZATION
1	Cameroun	3	University of Douala
			University of Buea
2	Mozambique	1	International Potato Centre
3	Ethiopia	1	International Potato Centre
4	India	1	Central Tuber Crops Research Institute
5	Burundi	1	International Institute of Tropical Agriculture (IITA)
6	Togo	1	Institut Togolais de Recherche Agronomique (ITRA)
7	Burkina Faso	3	Universite de Ouagadougou
8	USA	5	Mennonite Economic Development Association (MEDA)
			International Food Policy Research Institute (HarvestPlus)
			Bill & Belinda Gates Foundation (BBGF)
			Apoptosis-antagonizing transcription factor (AATF)
9	Kenya	2	Eastern Africa Agricultural Productivity Project (EAAPP)
10	Malawi	4	Department of Agricultural Research
			IITA
			Chitedze Research Station
11	DR Congo	14	IITA
			Institut de l'Environnement et de Recherches Agricole (INERA)
			Harvest Plus

12	CAR	1	IITA
13	Tanzania	10	IITA
			LZARDI-Ukiriguru
			Agricultural Research Institute
14	Liberia	2	Central Agricultural Research Institute
			GBARNGA
15	Cote d'Ivoire	5	Committee on Nuclear Regulatory Activities (CNRA)
16	UK	2	Food and Environmental Research Agency
17	Sierra Leone	16	IITA
			Sierra Agricultural Research Institute (SLARI)
			West Africa Agricultural Productivity Programme (WAAPP)
			NJALA University
18	Benin	14	Institut National des Recherches Agricoles du Benin (INRAB)
19	Uganda	11	International Potato Center
			Bill and Belinda Gates Foundation (BBGF)
			National Agricultural Research Organization
			Makerere University
			National Crops Resources Research Institute
20	Ghana	55	Catholic Relief Services
			CSIR-Crops Research Institute (CSIR-CRI)

			CSIR-Soil Research Institute (CSIR-SRI)
			CSIR-Food Research Institute (CSIR-FRI)
			CSIR-Savanna Agricultural Research Institute (CSIR-SARI)
			Royal House Chapel
			University of Cape Coast
			Kwame Nkrumah University of Science and Technology (KNUST)
			CSIR-Forestry Research Institute of Ghana (CSIR-FORIG)
			International Potato Center (CIP)
			Ghana Atomic Energy Commission (GAEC)
			University of Ghana
21	Nigeria	94	University of Nigeria, Nsukka (Faulty of Agriculture)
			Catholic Relief Services
			Harvest Plus
			Federal Institute of Industrial Research
			Federal University of Agriculture
			IITA
			National Root Crops Research Institute (NRCRI)
			Federal University of Agriculture, Abeokuta (FUNAAB)
			National Agric. Seed Council
			University of Ibadan
			IAR & R

22	Peru	1	Consultative Group for International Agricultural Research (CGIAR)

4.0 SUMMARY OF PRESENTATIONS

4.1 Plenary Sessions

Plenary Session 1: Chairperson: Dr. Peter Kulakow

Two papers, with focus on the Consultative Group for International Agricultural Research (CGIAR) and its activities were presented.

Paper 1: **CGIAR Research Programme on Roots, Tubers and Bananas (RTB): Engaging Partners and Enhancing Impact. (Presented by G. Thiele)**

CGIAR's Roots, Tubers and Bananas (RTB) research programme covers plantain/banana, cassava, potato, sweetpotato, yam and other root and tuber crops. The focus on RTBs was because they are major staples, cheap sources of energy and nutrients providing 14-60% daily calories, they are locally produced and traded in, and so are less subject to global grain price fluctuations, they constitute the backbone of food and income security for about 180 million people.

Paper 2: **Global, Regional and Local drivers of change in Cassava Value chains in selected countries in Africa: Implications for upgrading smallholder systems (Presented by J. Rusike)**

The objectives of the work included identifying market, technological, organizational and policy innovations for upgrading smallholder supply systems to improve performance.

The approach involved farm household surveys using rapid analysis value chain questionnaire interviews with players.

Plenary Session 2: Chairperson: Dr. Alfred Dixon

The presentations focused on Biofortification of Cassava varieties with micronutrients for improve nutrition to mitigate the effects of malnutrition particularly the incidence of Vitamin A Deficiency.

Paper 1: **Biofortification of Cassava: Progress and Challenges in Reaching the End-user (Presented by Paul Ilona)**

Highlights of the paper were that:

Food insecurity remains globally widespread. Lack of micro-nutrients (Vitamin A, Zn and Fe) causes stunted growth, preventable illnesses, lower cognitive ability, premature death, reduced ability to work and loss in GDP. In Nigeria efforts are being made to promote the cultivation and consumption of Vitamin A - rich cassava to mitigate the effect of Vitamin A deficiency. First wave of cassava varieties containing 6-8 μ/g of pro-Vitamin A have been released by the NARS in Nigeria, Democratic Republic of Congo, Malawi and Sierra Leone, using germplasm from IITA. Varieties with up to 20 μ/g have been selected and are being evaluated at CIAT. Land area under multiplication increased from 4ha in 2010 to >500 ha in 2012 while planting materials supply increased from 250 bundles in 2010 to >250,000 in two years.

Major challenges include skeptism, high cost of stem delivery, competition between food and income in the target population.

Paper 2: **Application of Near Infrared Reflectance Spectroscopy (NIRS) for screening of fresh cassava (*M. esculenta*) genotypes for high concentrations of Pro-Vitamin A carotenoids. (Presented by *O.E. Alamu*).**

Highlights of the presentation were that Vitamin A Deficiency (VAD) was particularly prevalent in Africa with children and pregnant women being the most vulnerable group. Cassava was a major staple food in the developing world, including Africa, providing a basic diet for approximately 500 million people. The limitations of cassava utilization included the relatively low nutritional quality - low protein and micro-nutrient contents of the roots. There was the need to enhance the nutritional content of cassava through biofortification with micronutrients. A study was therefore conducted to validate NIRS calibrations for analyzing provitamin A carotenoids content of selected fresh yellow root cassava genotypes. Results showed that the NIRS could be used for fast and cost effective cassava carotenoids quality assessment in large sample sets based on fresh material. The NIRS was therefore a useful tool for fast selection of genotypes during crop improvement.

Paper 3: **Application of Experimental Auction Mechanisms and Sensory Evaluation Methods to Understand Consumer Acceptance of Biofortified Yellow Cassava in Nigeria (Presented by *A. Oparinde*)**

Highlights of the presentation were results of a study conducted to better understand consumer preferences – whether consumers were willing to pay a premium price for food made with biofortified yellow cassava compared to food made with local varieties and to investigate drivers of 'willingness to pay'. Results indicated that with information on the nutritional qualities, very deep yellow cassava has a higher premium. In one location even without information, light yellow cassava could favourably compete with local varieties.

Paper 4: **Bio-fortification of cassava for Pro-vitamin A in Nigeria: a model for collaborative scaling out for reduction of vitamin A deficiency in Africa (Presented by *C.N. Egesi*)**

On-farm trials were conducted in 10 states in the cassava growing zones in 2012/2013 using 5 pro-vitamin A cassava and some checks. Data were collected on fresh yield, root number, plant establishment, gari quality, *fufu* quality and ease of peeling. Two varieties with moderate carotene content were released in December 2012. Twenty five (25) pro-vitamin A clones, with medium to high pro-vitamin A and high dry matter content, were planted in a crossing block in June 2013. Planting materials were distributed to farmers in two states (Abia and Ikwa Ibom states) through Adopted Village and School Outreach. New varieties with much higher pro-vitamin A levels (9 – 14 µg/g) are in the delivery pipeline. The goal was to meet the HarvestPlus target of 25µg/g.

Plenary Session 3: Chairperson: Loretta Byrnes

The presentations focused on Seed Systems.

A brief introduction to Seed systems was presented by Loretta Byrnes of the Bill and Melinda Gates Foundation who chaired the session. She emphasized that the Seed System was important because

- Seeds were the mechanism for delivery of improved genetic material
- Quality seed of Improved and desired varieties were not reaching farmers
- Delivery mechanisms for quality seed were not sufficiently effective or sustainable

According to her the Seed System does not begin from varietal release as some believe but that breeding was part of the system. Production of "quality" planting material was very important and this could be achieved through Virus indexing, Tissue Culture Production and Conservation

of starter material of improved varieties, among others. She also indicated that Quality Control could be achieved through Testing Systems, Establishment and validation of laboratories as well as Capacity building of laboratory technicians, inspectors and sample collectors. Four other presentations were made as follows:

Paper 1: **Yam Improvement for Income and Food Security in West Africa: Update on Seed System. (Presented by *N. Maroya*)**

The presentation began with FAO statistics comparing global yam production and the contributions from West Africa (as a whole) and Ghana and Nigeria combined. He described yam as a high value crop, very expensive and of high cultural value and that it was the third (3rd) source of protein in West Africa after maize and rice. Yam production was however limited by scarcity, high cost and poor quality of seed yam. This situation was being addressed under a project dubbed Yam Improvement for Income and Food Security in West Africa (YIIFSWA), which was being implemented by Research Institutes (5), Universities (7), Governmental organizations (5), and Nongovernmental organizations (3). Bill & Belinda Gates Foundation (BMGF) was supporting this project being implemented in Ghana and Nigeria involving the formal seed actors in the two countries.

Paper 2: **Commercially Sustainable, Quality Assured Cassava Seed System in Tanzania: Pilot Innovation. (Presented by *L. Good*)**

The issues being addressed according to the presenter were:

- Traceable source of Tissue Culture generated and or laboratory tested planting materials
- Making the private sector seed multiplication attractive to the entrepreneur:
- Maintaining quality assurance and disease management

The progress made so far were:

- 105,000 stems have been produced by private Cassava Seed Entrepreneurs (CSEs) while 120,000 stems have been produced from research managed fields.
- Two stakeholder meetings have been held and test standards have been established to be used on pilot plots.
- Sample source planting material collected and tested

- Each multiplication site has been registered in order to obtain inspection services and certification

- Twenty (20) new CSE's recruited through competitive application.

Paper 3: **Developing Clean Seed Systems for Cassava: Experience from the 5CP Project. (Presented by *J.P. Legg*)**

Highlights of the presentation were:

- The structure of a clean seed system should begin with Breeders →Growers → Clients
- Starting materials could be improved by establishing disease-free pre-basic stocks of planting material of breeders' best varieties.
- Quality degeneration could be reduced by preventing disease spread - site location should be carefully done.
- Management of diseases could be improved by roguing, planting resistant varieties and vector control.

An efficient Seed System would require:

- Sites for the production of clean material
- Sensitive, cheap virus diagnostics
- Tissue culture with virus indexing for mass multiplication.

Paper 4: **Cassava Seed Regulations – Multi-Stakeholder Engagement to Increase the Relevance and Application of Stem Quality Standards. Data and insights drawn from Sustainable Cassava Seed System (SCSS) Project in Nigeria. (Presented by *I. Itoandon*)**

This presentation discussed the collaboration of Catholic Relief Services (CRS) and a number of key cassava stakeholders on the Sustainable Cassava Seed System (SCSS) Project in Nigeria, to develop a more commercially oriented cassava stem multiplication system. This included a cassava stem protocol that sets a benchmark for cassava planting material at breeder, foundation, and certified seed seller level.

Key Achievements of SCSS Project to date (end of 2nd year) include:

- the establishment of 48ha of cassava planting material fields by Seed Entrepreneurs;
- establishment of 6ha of demonstration fields;

- 3,390 bundles of foundation seed have been sourced from the National Root Crops Research Institute and IITA

Challenges include**:**

- The supervisory agency -National Agricultural Seed Council (NASC) - does not have the requisite manpower, and its seed certification officers lack the requisite skills in the assessment and certification of vegetative seed fields.
- High cost associated with compliance with the protocol cannot be recovered at sale because stems are still being distributed freely by other interventions.
- Huge knowledge gap among stakeholders on standard agronomic quality issues and practices
- Extension services are not small holder farmer friendly in design and require a lot of promotion and awareness creation.

Recommendations:

- Increased production and distribution of certified seeds of improved varieties through small holder entrepreneurs should be encouraged
- The cost of compliance to seed regulation should be reviewed
- The manpower base of the National Agricultural Seed Council (NASC) and Extension Service Providers should be strengthened and upgraded

Plenary Session 4: **Chairperson: Dr. T. Graham**

The session dwelt on socio-economic aspects of root and tuber crops. Most of the presentations centered under the project Support for Agricultural Research for Development on Strategic Commodities (SARD-SC) on root and tuber work on the continent. Four presentations were made in the session.

Presentation 1: Aiming for a transformational impact on cassava through the SARD-SC Project: (Presented by *Akem, C.*)

The presenter gave the basic project information of the, title, project cost, centers involved, and multilocational involvement. The objective of the study was to enhance the nutritional, food security and poverty alleviation through increased cassava productivity.

Presentation 2: Progress of achieving nutritional and security on cassava through the SARD-SC Project . (*Yomeni et al.*)

The speaker spoke about the strategies to be used to achieve this goal and added that an evaluation of high yielding pests and disease tolerant genotypes was in progress. He also spoke about the linkage between the national and local Innovation platforms. He talked about the conduct of a cassava sub-sector analysis as well as a baseline survey for each target country and also suggested that a study on a complete technology adoption was a critical need.

Presentation 3: Application of Economic Analysis to Determine the Returns of Cassava Production:

The essence of this study was to determine the research impact and potential benefit in cassava production. According to him the benefit of research starts after 10 years. The period from 0-10 years was the lag period. He indicated that adoption in cassava technologies could be classified into "High" and "Low". Under high adoption, Nigeria could be classified as having 18% adoption with the rest of Africa having 15 %. Under low adoption, Nigeria could be classified as having 10 % and the rest 5 %. Some of the technologies considered for adoption included:

- Biological control of green spider mites
- Integrated sustainable soil fertility management
- Adoption of high yielding drought tolerant varieties
- Adoption of high yielding varieties with improved nutritional content.

Presentation 4: Implementation of Marker Assisted Research in Determining Drought Tolerant Cassava Genotypes. (*Dr. Emmanuel Okogbenim*, NRCRI)

The presenter posed the question "why drought'? He then indicated that drought was a major limiting factor affecting the yield of cassava and other crops. He stated that yield could be reduced by over 50 % under drought. There was the need for studies on drought because large percentages of arable lands under cassava production also fall in dry areas. The idea was to utilize molecular breeding to obtain materials that were tolerant to drought within a short time. He mentioned the identification of several selected genomic regions. He described the activity flow chart and the designs used. He mentioned that several traits were observed and that there were good variations of these traits.

Plenary Session 5: Chairperson: Dr. Edward Carey

The importance of sweet potato as a food security crop was emphasized by the speakers. Speakers also spoke on the role of sweet potato for biofortification and solving problems associated with Vitamin A deficiency. The presentations also gave the potential of sweetpotato to improve smallholder incomes and nutritional wellbeing. The crops' role in labour utilization and as a source of employment for the youth was also stressed. The presentations also considered effect of fertilization on sweetpotato, consumer insights about the crop, pest and disease aspects on sweetpotato production, and role of the crop for profit and health initiative. Sweetpotato's role in employment generation, analysis of sweetpotato value chain and gender operations on the crop were also tackled. A total of seven papers were presented:

Presentation 1: Effects of Organic and Mineral Fertilizers on total Antioxidant, polyphenolic and carotenoid contents of Orange fleshed sweetpotato tubers. (Presented by *Adama Hema*)

Burkina Faso is known to be one of the countries suffering from perpetual food insecurity and low food diversity leading to high prevalence of malnutrition and micronutrient deficiencies. Promoting micronutrient rich orange fleshed sweet potato varieties was needed to combat malnutrition in sub-Saharan Africa where more than 43 million children under five years suffer from malnutrition. Micronutrients were basically made up of antioxidants which protect the body against diseases. Common ones include vitamin A.

It is known that mineral fertilizer application affect micronutrient accumulation in sweet potato. However, the extent is not well known so the objective was to determine the effect of both mineral and organic fertilizers on the total carotenoid content (TCC), total antioxidant content (TAC) and total polyphenol content (TPC).

It was found that the different fertilizer types had positive effect on total carotenoid, polyphenols and total antioxidant content. However, best results were obtained when the fertilizer types were used in combination. With a combination of mineral and organic fertilizer, it was possible to increase TCC, TAC and TPC to 44%, 68.39% and 62.63%, respectively.

Presentation 2: Consumer insights and acceptance of sweetpotato products in Ghana. (Presented by *Charity Wiredu*)

The project is part of a collaborative research between the International Potato Improvement Centre (CIP) and the national programme at Crops Research Institute under the sponsorship of

the West Africa Agricultural Productivity Programme. Sweet potato is a very important crop in Ghana but most of the breeding research activities have focused on yield, nutrition and reaction to pests and diseases without much emphasis on market attributes in reference to consumers' and producers' preferences. Needs-assessment studies were necessary to ensure the success of the project.

Objectives were to evaluate consumer knowledge and obtain purchasing and consumer drivers of sweet potato and also assess consumer acceptance of sweet potato products. The study was to also determine the most important sensory attributes that drive sweet potato products. The work was carried out in the Upper East, Volta, and Central Regions of Ghana. Twenty eight sweet potato samples were used for the study. Consumer survey and interview and sensory evaluation were conducted in the study areas to obtain the needed information. It was observed that in terms of varieties, white fleshed sweet potato varieties were widely consumed. Interestingly, 97% of the respondents also considered sweet potato as snack. Consumers' issues of concern were related to the bitter taste of some cultivars, lack of product diversity, limited information on health benefits as well as scarcity of sweet potato on the market. Eight genotypes of sweet potatoes were consistently acceptable in all the study sites. The study revealed that most consumers were not aware of the health benefits of sweet potato consumption. Sweetness also appeared to be the major purchasing and consumption driver of sweet potato. Taste was the best predictor for consumers of sweet potato products.

This study has opened a new page on the need to promote immediate product development alongside awareness creation of currently available varieties. The study also observed the need to develop rapid effective sensory protocol for germplasm screening for reduction costs associated with screening large number of varieties since few experts can be trained using the protocol to screen the varieties concern.

Presentation 3: **Management of sweetpotato weevil, *Cylas puncticollis* (Boh.) (Coleoptera: Brentidae) infestation using varietal and cultural control at Kuru, Nigeria (Presented by *C. N. Ehisianya*)**

Sweet potato weevil is a major dry season pest that causes severe damage to sweet potato resulting in up to 100% yield loss in severe cases. It attacks all plant parts. The main control method has been the use of chemicals. Unfortunately, chemical control has serious challenges especially in situations where the user does not apply the necessary precautions. Thus we need to develop cost effective management strategies. This study explored the possibility of using varietal and cultural methods to control the weevil in Nigeria. Three tillage methods (mounding,

ridging and planting on flat) and three harvest times (4, 5 and 6 months after planting) were used).

The results obtained indicated sweet potato weevil attack/damage was significantly influenced by variety. Two varieties were severely affected by the weevil though they gave higher yield than the others. One genotype which had the least yield was the most resistant to the weevil infestation. Time of harvesting also had an effect on root yield with the 5 MAP giving highest yield due to root dehydration as a result of low rainfall. Root infestation and damage also increased with late harvesting as a result of low rainfall and high temperature.

Although planting on flat resulted in the least infestation compared to ridging, root yield was compromised irrespective of the time of harvest. Vigorous production of varieties that do well in the rainy season were recommended.

Presentation 4: Contribution of infant flour enriched with OFSP to improving the nutritional and immune status of young children moderately malnourished in the medical district of saint-camille, Ouagadougou. (Presented by *Omar Toe*)

In Burkina Faso, vitamin A deficiency is a public health problem that affects children under five years, pregnant and lactating mothers. Strategies to combat this deficiency include promotion of exclusive breast-feeding, supplementation with vitamin A capsules, enrichment of edible oils with vitamin A and finally promoting the consumption of foods that are rich in vitamin A. The general objective was to evaluate the contribution of orange fleshed sweet potato (OFSP) in improving the nutritional and immune status of moderately malnourished children.

The study showed that the OFSP improved the nutritional status of malnourished children. The consumption of porridge made from OFSP reduced the mobility of malnourished children over 30% compared with children who were fed on MISOLA. Whereas children who consumed MISOLA recorded very low levels of serum retinol level, children who consumed OFSP increased their levels of serum retinol. Other biological tests such as rate of antioxidant in plasma, rate in haemoglobin as well as red and white blood cells need to be done.

Presentation 5: Gender Operation and Labour Utilization In Sweetpotato Production In Ebonyi State, Southeastern Nigeria. (Presented *Nwaigwe Grace*)

Though sweet potato is an important staple in Nigeria, men and women perform different functions and have unequal decision power to sweet potato production. The understanding of gender contribution in sweet potato production is important based on the potential in poverty alleviation.

The objective was to examine the labour contributions of the agronomic practices in sweet potato production across gender in the study area.

The study revealed that farm activities were dominated by females. The only activity that men dominated was in the area of mounding and ridging. This was due to the energy intensive nature of this land preparation method. Planting materials were found to be procured from the previous fields by farmers probably as a result of lack of irrigation technology.

Family members were also found to be main sources of labour in most of the households in the study area. Majority of the sweet potato farmers were still planting local varieties in the study area.

The study recommended the enacted of relevant policies to encourage sweet potato production by providing access to inputs at subsidized rates. Famers should also be trained on the relevance of sweet potato irrigation farming and nursery to enable farmers' select cleaner planting material. Farmers should also be encouraged to plant the new released varieties.

Presentation 6: Analysis of the value chain of sweetpotato and household food security in southern Benin. (Abdul Baaki Bankole)

Sweet potato is one of the major food crops that could solve the problem of food insecurity and poor nutrition in Benin. This study aimed to promote sweet potato for local market and the sub-regional market and identify the constraints along the sweet potato value chain. The study was conducted in the selected locations within the southern part of Benin. The outcome of the study revealed two value chains of sweet potato. One was intended for the local market and the other for the sub regional market. Producers and wholesalers respectively are the players that add more value to the chain. Promoting the sweet potato value chain requires improving the technical capacity of some key stakeholders such as retailers to develop effective storage/conservation technologies. Improving access to agricultural credit will promote production and encourage the consumption of sweet potato and its transformation into various productivity levels.

Presentation 7: Highlights from four years of implementation of SASHA (Jan Low). (by Dr. Ted Carey)

SASHA (**S**weet potato **A**ction for **S**ecurity and **H**ealth in **A**frica) is part of a bigger project of sweet potato health initiative project which covers 17 priority countries in three sub regions.

It started in early 2009 with the target of covering 10,000 farmers. So far only 3,000 farmers have been covered.

The five major programmes under SASHA are:

1. Breeding and Varietal development: Population development
2. Weevil Resistant sweet potato using transgenes
3. Seeds systems
4. Delivery systems and
5. Management and sweet potato support platform

The speaker spoke on the platform of sweetpotato management. It was a platform which provided technical backstopping for the sweet potato breeding community. The platform also strengthens sweet potato breeder community of practices. Annual meetings are held for breeders. 15 sub-Saharan countries have since participated in four that have been organized at various venues; Uganda, Mozambique, Belgium and Rwanda. Breeders meet at such meetings to discuss and agree on standard protocols and develop clone selector to ease in data entry and analysis for breeding trials. Each platform has a quality and clean up capacity to ensure the success of the programme. A key goal of the sweet potato platform is to implement ISO 17025-like standards with partners in Kenya, Mozambique and Ghana by October, 2013.

4.2 Scientific Sessions: Summary of presentations

Identification of molecular markers associated with early bulking in cassava (*Manihot esculenta* Crantz). *(Olasanmi B)*

The study was set up to identify molecular markers linked to quantitative trait loci (QTLs) associated with high and early tuber productivity in cassava using bulked segregant analysis (BSA) and use the markers to select EB-HY genotypes (marker assisted selection). Six parents were crossed and the hybrids evaluated for early bulking and high yield (EB-HY) at 7 MAP. Nine SSR markers were closely associated with early bulking and high yield in six of the nine hybrid populations. The SSR markers identified in this study were useful in selecting for early bulking and high yield (EB-HY) in six of the nine cassava hybrid populations.

CASSAVABASE (cassavabase.org): an integrated field breeding and genomics database enables accelerated genetic gain in cassava. - *Afolabi Agbona et al.*

With the advent of modern breeding methodologies in plant breeding and for effective realization of breeding objectives, and to fully explore the full potential of crop plant; there was a need for an effective, centralized and easily accessible database.

Cassavabase is a central data store for the NextGen Cassava Project. It is built on the platform for sol genome network. It is an open access to data and supports breeders with comprehensive information on phenotypes and genotypes. It increases data exchange between breeders. The tools involved include Phenotype, Ontology browser, Statistical tools for genomic selection implementation, Maps and Markers. The form for adding to the database (online) was presented.

Question: Is the database accessible by everybody?

Answer: Individuals can access the database or in batches.

Genetic Characterization of Exotic and Landraces of Cassava (*Manihot esculenta* Crantz) in Ghana. (K.Y. Karim)

The future contribution of cassava to the world's food security, depends on the exploitation of its genetic diversity through breeding. Thus, assessing variability through genetic charaterisation of its germplasm seems paramount for crop improvement and successful germplasm management. The cassava accessions evaluated were 28 exotic and 17 landraces of cassava, selected as representatives of clusters from a dendrogram based on morpho-agronomic characterization of 150 accessions from CSIR-Crops Res. Institute, Ghana. Morpho-agronomic characterization separated the germplasm into 2 main clusters (A and B) with A having only 2 accessions and B 43 accessions. Molecular markers also grouped the accessions into 2 clusters A and B. However the clusters here contained different accessions because they are not affected by the environments.

The application of morphological descriptors in managing germplasm should be backed by the use of molecular markers, because the former alone does not reveal much diversity due to the effects of the environment on quantitative traits.

Phenotypic evaluation of cassava mapping population for drought resistant traits in Guinea Savannah ecology of Ghana. *(Kwabena Acheremu)*

Cassava is generally known to be drought tolerant. However, yields penalty can be incurred in susceptible cultivars. Irrigation can help but it is capital intensive. Alternative cost to develop drought tolerant genotypes should be identified. The study therefore sought to identify

quantitative trait loci (QTLs) associated with drought and yield performance and ultimately develop a new generation of top performing elite lines with drought tolerance.

157 pseudo-F_2 drought tolerant progenies of cassava from two non-inbred parents were evaluated with the two parents and five local cassava materials. Mean root yield of the progenies recorded was 18.1t/ha, with the maximum yield of 45.0 t/ha. The mean dry matter (DM) recorded was 28.8 %, with the majority of the progenies recording DM ranging from 28.80 to 39.75% above the mean. Ten (10) of the progenies recorded the highest root yields ranging from 36.25 to 41.98 t/ha, which are above the highest root yield recorded by the parents. Seven lines recorded a DM ranging from 36 to 39.8%, a range that was higher than that of Pontisange, one of the best performing local checks in terms of DM percentage.

Question: The drought tolerance component was not clear from the results.

Answer: This was expressed in the tuber yields.

Development of Cryobanking for Long term *Ex-situ* conservation of cassava - *Adeyemi Abigael*

Diversity loss due to biotic (pest and diseases) and abiotic stresses can ruin the future of cassava. There was need for cassava genetic resources conservation. The study highlighted the importance of cryopreservation for long term storage of germplasm and safety back up for medium term conservation. Cryopreservation involves the maintenance of living tissues/cells in a static and frozen state and keeping the regrowth capacity of the cells. Cryo-preservation stands a good chance for a reliable long term conservation of cassava genotype diversity. Droplet vitrification protocol gives a promising approach for cryo-banking. It is hoped that at the liquid nitrogen temperature (-196^{o}c), virus in an infected plant can be denatured leaving the regenerated plantlets free of certain viral infection.

Question: How long does it take to recover/regenerate materials in conservation?

Answer: The materials regenerate but the rate is reduced.

Dry Matter Determination in Cassava — A Better Approach. *(P.O. Iluebbey)*

One of the most important traits of interest to researchers and processors was the dry matter (DM) content. Knowledge of the best method to determine dry matter was therefore key to all stakeholders in the cassava value chain. Six genotypes of different DM contents were selected. Three different sample masses of 5g, 50g and 100g were used. Samples were taken from different portions of the roots - Proximal, Central and Distal. Results showed that the portion immediately after the peel has higher dry matter content than the core. Dry matter does not

significantly change along the root lenght. Using a whole root with fresh weight of more than 50g gives better dry matter accuracy.

Question: Does DM not depend on maturity?

Answer: The study looked at DM at different portions of one year old plants.

Question: Up to one year cassava goes through different seasons with hydrolysis of starch to sugar. Did you consider that?

Answer: The study did not take seasons into consideration.

Question: In your presentation you mentioned whole tubers. Do they include the peels?

Answer: Peels are not eaten so they were not included in the analysis.

Question: Can you explain why DM reduces towards the pith?

Answer: I shall find out later.

Evaluation of performance of introduced yam Bean (*Pachyrhizus spp.*) in three Agro-ecological zones of Rwanda. *(J. Ndirigwe)*

Yam bean *(Pachyrhizus sp)* is within the legume family with edible tuberous roots. It has three closely related cultivated species - *P. tuberosus, P. erosus and P. ahipa*. It produces heavy storage roots (up to 145 t/ha) with up to 24% dry matter (DM). Unlike root crops, YB storage roots are richer in protein (18%) and micro minerals (Fe, Zn and Ca). Nine introduced genotypes from CIP (4 Ahipa (bushy) and 5 *Erosus* (climbing) were evaluated for adaptability in different agro-ecological zones in Rwanda. *P. erosus* yielded higher than (*P. ahipa*). However Harvest Index (HI) and storage root dry matter content were significantly higher in *P. ahipa* than in *P. erosus*. Accessions of *P. erosus* were more resistant to nematodes and fungal attacks than those of *P. ahipa*.

Question: Did you observe any nodulation?

Answer: No. I was interested in the root yield only.

Question: Is it a popular crop in Rwanda? Is it a native crop of Africa?

Answer: No. It has just been introduced. It is from North America but there is an African genotype.

Flow behavior of starch from three parts of yam tuber during tuber growth – ***Degbeu, C.K.***

The importance of yam as staple foods, is due to its starch content. Some properties of yam starch include its high amylose content, viscosity stability to high temperature and low pH. A study was conducted to show the rheological variation of starch in two varieties of *Dioscorea cayenensis*: kponan and kangba during the growth period in three tuber parts. Tubers were harvested at 16, 18, 20, 22, 24 and 26 weeks after planting and cut into sections for starch extraction. Results of the study showed that the flow behaviour of yam starch from three tuber parts was not influenced by the maturity period. At maturity, the viscosity ratio was high for starch from all tuber parts. In the early stages of tuberization, the viscosity ratio was weak indicating the possibility to use this gel as thickening agent for shearing sauce.

Question: What is the usefulness of this study?

Answer: It will help us to know more about the qualities and uses of yams.

Working with Community-based Organizations to Promote Consumption of Orange Fleshed Sweetpotatoes (OFSP) through On-Farm Participatory Trials. ***(S. Gorrettie)***

Sweetpotato is an important staple in Uganda. Most varieties consumed are white or cream and so are low in Vitamin A content. The OFSP is a cheap source of Vitamin A but has not reached many consumers, hence Vitamin A Deficiency still exists in Uganda. A study was conducted to evaluate the acceptability of OFSP varieties by consumers. Community based organizations (CBOs) and farmers were selected from 5 districts for the study. Three new OFSP clones and a check were evaluated for reaction to Sweetpotato virus disease, *Alternaria,* weevil damage, tuber yield and palatability. Initially some of the farmers had been misinformed to think that OFSPs are Genetically Modified Organisms (GMOs). At the end of the study the perception of some farmers changed. In the end two of the OFSP were earmarked for release.

Question: What are scientists' perceptions of GMOs in Uganda?

Answer: Efforts are being made to educate the politicians some of whom think that GMOS have already entered the food market. A Bill on GMOs is pending in Parliament.

Question: Are consumers prepared to pay a premium price for the OFSPs?

Answer: As a result of intensive education on the health benefits of OFSPs some consumers are willing to pay a premium price for OFSP.

Speed Breeding and Variety Release for Orange Fleshed Sweetpotato Cultivar Diversity in Malawi. (*Chipungu FP)*

Sweetpotato and potato together contribute 8% to the total caloric intake at household level. Sweetpotato production expanded dramatically in the 1990s due to recurrent droughts and increased fertilizer prices which adversely affected maize production. Sweetpotato breeding program aims at developing varieties that are high and stable yielding, resistant/tolerant to major prevalent diseases such as Sweetpotato virus complex disease ({SPVD} and *Alternaria* and sweetpotato weevil {SPW}).

They should have desired root qualities: colour (white, cream, yellow, orange) to meet local cooking and consumption requirements (high dry matter content, sweetness. They should adapt to local environmental conditions and cropping systems. The strategy would be to speed breed varieties in one year and test them for two seasons prior to release.

Question: How will farmers get the planting materials?

Answer: They are involved in the evaluation so they will select materials of their choice

Genotype by Environment Interaction and Productivity of New Generation Cassava Genotypes Developed for Food and Industrial Uses in Nigeria. *(*Presented by *P. A. Kulakow)*

Large genotype by environmental interaction (GEI) makes effective testing difficult and distorts ranking of genotypes performance in different environments. Statistical tools for analysing Genotype by Environment interactions include GGE biplot. GGE have the ability to eliminate noise from the data, accurately summarize data and graphically present results in an easily interpretable and informative biplot that shows both main effects and GEI. The study was to examine genotype by environment interaction (GEI), and yield stability of 40 new generation cassava genotypes across 14 environments in Nigeria using AMMI, GGE and the modified rank-sum method. Most of the new generation genotypes yielded better than the established improved check, IITA-TMS-IBA30572, and the most widely adapted landrace (TMEB 419). The 8 high yielding genotypes identified by the rank-sum classification have both high fresh root yield and high dry matter content. This suggests that dry matter content level could be maintained while improving root yield.

Question: Did you observe any diseases? At what moisture content level did you measure the Dry matter?

Answer: I can't recall seeing any disease. The moisture content was determined.

Evaluation of yam bean (*Pachyrhizus spp*.) accessions for root yield and nutritional quality under growing conditions of Uganda (Presented by *C. Andiku*)

Yam bean is grown for its edible tuberous roots, which are high in protein, starch, iron and zinc contents. The crop has excellent biological nitrogen fixation properties. Yam bean is new and nearly unknown in Uganda. Its adaptability under growing conditions in Uganda is not known. The study formed the baseline for yam bean breeding programme/production in Uganda since the crop is nearly unknown in Uganda. Twenty-five (25) accessions were assessed in different agro-ecological zones of Uganda. Fresh storage root yields were significantly different across the different locations. The country has two mega environments for yam bean production. However Yam bean has potential to grow in many parts of the country.

Question: The Yam bean known in Africa is a climbing with edible fruits. What you presented is not a climbing plant so why that name.

Answer: The African yam bean is different from the one I presented.

Question: Why spend resources on yam bean instead of promoting yam, cassava, cocoyam and sweetpotato?

Answer: The crop has abundant Zinc (Zn) and Iron (Fe) for improved human nutrition.

Question: What informed your choice of locations for the trials?

Answer: It was the soil type and vegetation.

Advances in Cassava (*Manihot esculenta* Crantz) and Yam (*Dioscorea* spp.) Breeding and Development in Sierra Leone: 2008-2012 (Presented by *S.N. Fomba*)

This report is about advances made in cassava and yam breeding and development since October 2010 after the 11th ISTRC-AB Symposium in Kinshasa in DR Congo. The objectives included developing high quality cassava and yam varieties that possess high yield, good appearance, organoleptic quality, postharvest attributes and disease and insect resistance traits. Cassava genotypes with high dry matter content that can be recommended for use in gari, starch, and flour production have been identified. The criteria used by farmers for

selection of cassava genotypes were: high yield, disease resistance, pink skin colour, and good cooking ability. Eight new cassava genotypes are in the pipeline for release.

Ten yam genotypes with yield ranging between 6.0 and 10.8 t/ha significantly out-yielded the local checks in staked plots. Six genotypes with yields ranging from 4.7 to 7.7 t/ha significantly out yielded the local checks in the non-staked plots. Five genotypes are in advanced stages of testing to be released at the end of the process. The economics of yam production under staking and non-staking conditions was also studied. Results indicate that commercial production was feasible and profitable depending upon the yield of the genotype and its desirable market traits.

Comments: 40 -50 % DM from cassava is impressive. Why study staking in an area where farmers don't stake because the stakes are not available?

The number of yam varieties to be released is high.

Introgression of Cassava Mosaic Disease resistance into farmer preferred cassava genotypes in Ghana (Presented by *E. Y. Parkes*)

Cassava supports over 800 million people in sub-Saharan Africa and is grown in 39 countries. Production constraints include diseases such as Cassava Mosaic disease (CMD), Anthracnose disease (CAD), Bacteria Blight (CBB) and Root Rot. As part of the efforts to address the situation, eight CMD and GM resistant genotypes from Latin America (CIAT) were crossed with three cassava landraces and one IITA improved genotype. Results of analyses done showed that *Dabudabu*, a landrace is a putative new source of resistance to CMD. High performing hybrids were identified and evaluated.

Question: Some CIAT materials are not good against CMD so why did you go there (and not Nigeria) for materials?

Answer: CIAT has some materials into which CMD resistance has been introgressed.

Evaluation of Yellow-Root Cassava Clones for High Yields and Earliness in the Guinea Savanna Ecology of Ghana. (Presented by *K. Acheremu*)

The objective of the study was to select high yielding β-carotene cassava with high dry matter content for production in the major rainy season in Northern Ghana. Seven (7) cassava genotypes were planted together with a local check (Biabasse) for evaluation. Results from the

study showed that three genotypes showed earliness in bulkiness and high yielding potential than the check (Biabasse).

Physicochemical properties and baking qualities of baked wheat products supplemented with pigeon pea and cassava flours (Presented by *Sarah Chilungo*)

The presenter mentioned the importance of wheat, global production level and its unique component, gluten which makes its dough cohesive and viscoelastic. The high retail price of baked products in rural communities called for alternative formulations of flour for breads and cookies making. Hence a blend of pigeon pea, cassava and wheat flours was expected to result in products with a good balance of essential amino acids. The objective of the study was to evaluate the physicochemical and baking qualities of mixture of wheat-cassava-pigeon pea flour for bread and cookies.

Question: **Abena Achiaa Boakye**

- Was there any special reason for the difference in substitutions used for the bread and cookies total of 30% for bread and 40% for cookies?

Answer:

- The 40% substitution for bread was done in the preliminary studies but was not included in the findings and main study because of associated challenges

Question: **Dr B. Maziya-Dixon**

- On finding different alternatives of utilisation of legumes, including pigeon pea, we should embark on such studies, if there were surplus production of pigeon pea. I would want to know the production of pigeon pea in Malawi

Answer:

- There is the need to increase the productivity of pigeon pea as the current yield is just slightly over 1 tonne/ha.

Ameliorative potentials of cocoyam (*Colocasia esculenta* L) and unripe plantain (*Musa paradisiaca* L) on renal and liver growths in Streptozotocin induced diabetic rats (Presented by *Chinendum Oguna*)

An overview of diabetes mellitus and how its prevalence was rising globally, including the rural Nigeria populations were given. The objective of study was to investigating the effect of cocoyam and unripe plantain flours on renal growth in diabetic rats and screening for the antioxidant activity of cocoyam and unripe plantain flours.

Question: **Dr. Adewale**

- What is the policy implication of your results?

Answer:

- To communicate to the wider research audience to confirm the findings and relay to the health authorities and private sector the potential opportunity that can be derived from the results.

Question: **Dr. F.K. Amagloh**

- Did you apply for animal ethics?

Answer:

- Yes I did

Nutrient content and pasting properties of defatted yam bean (*Pachyrhizus erosus*) seed flour (Presented by *Abass*)

The presenter indicated that though yam bean produces roots for food and feed, it still remained underutilized and its substantial seed produced not exploited though rich in oil and protein. The objective of the study was to investigate the nutrient composition and flour pasting properties of yam bean (*P. erosus*) seeds recently introduced into Uganda.

Question: **Prof. W.A. Plahar**

- The main aim of the production of *P. erosus* seed flour was to promote its utilisation. How do we detoxify the seeds to make them safe for human consumption?

Answer:

- There is an on-going detoxification project in Europe and until a breakthrough is in sight, this effort will help identify the opportunities that exist for the seeds.

Comments: **Dr. A.A. Adebowale**

- You should have concentrated on finding solutions to the toxicity before testing end use applications in food.
- Retrogradation is not desirable hence don't present it as a positive characteristic in food processing.

Question: **Dr. F.K. Amagloh**

- How efficient was your de-fattening system as I find 5 % fat in your sample? You blended the wheat flour at different ratios. Even though you did not do

sensory evaluation, in your view what percentage combination would you consider appropriate for baking bread?

Answer:

- The initial fat was 25% and reducing to 5% showed much reduction. I have noted the use of the term low-fat yam bean seed flour

Comments: **Charity Sabeng Poku**

- I suggest that other commercial root and tuber and legumes flour be compared with yambean seed flour in terms of pasting properties for meaningful conclusions

Performance optimization of cassava pelleting machine

An effort made to model for the cassava pelleting machine by using Dimensional Analysis was presented. The models developed were evaluated and optimized using Response Surface methodology. The objective of the study was to develop a mathematical model for analyzing the machine using dimensional analysis and conduct a performance optimization of the machine.

Question: **Dr. J.T. Sheriff**

- Are you aware particle size of the feed has effect on power consumption?

Answer:

- Yes.

Comment:

- You have to check the dimension of dry matter in your table of variables.

Descriptive sensory analysis and consumer acceptability of a cooked paste ('amala') from sweetpotato. (Presented by *Yinka Fetuga*)

Processing of sweet potato is on a small-scale in Africa and consumer acceptance was a pre-requisite before commercial production. The objective of the study was to investigate the sensory attributes required for acceptable sweet potato cooked paste ('amala') for quality control purposes during the commercial production of sweetpotato flour ('elubo').

Comment: **Martha S E Williams**

- Control should have been used to attain appropriate characteristics.

Question: **Nyahabeh Anthony**

- I observed that the panelist were people having lunch together. Is that the right method to conduct sensory evaluation?

Answer:

- This is an acceptable mode of empanelling for sensory evaluation.

Question: **Prof. Tewe O. Odeleye**

- Can you compare the oxalate content of different sweetpotato varieties? How does that affect the colouration of the 'amala from sweetpotato'

Answer:

- I did not investigate that.

Comment. **Dr. Achidi A.U.**

- It would be good to have a composite of sweetpotato with yam and cassava.

Comment. **Dr. (Mrs.) S.A. Sanni**

- In product/sensory assessment it is always right and necessary to use control samples.

Answer:

- Use of control sample is one of the standard procedures for sensory evaluation however, it is not always important and applicable.

Comments: **Olotu Ifeoluwa**

- There were codes without clues.
- The test of significance was not shown though it was indicated in the methodology.

Answer:

- The comments are noted.

Question: **Franscis Alacho**

- Was any microbial study done, if not it should be included because of the nature of the method of processing and storage used during processing?

Answer: No. Suggestion is well noted.

Glycemic index and Glycemic load values of three Ivorian mixed foods in healthy subjects (By Nestor K. Kouassi)

The anticipated prevalence of diabetes in Cote d'Ivoire by 2025 will be about 4% by 2025. The glycemic index of foods has implications for the prevention and treatment of the major causes of morbidity and mortality. Little is known about the glycemic index of commonly consumed Ivorian traditional foods. The objective of the study was to investigate the glycemic index and the glycemic load of three traditional meals consumed in Côte d'Ivoire.

Question: **Prof. W.A Plahar**

- Is there any practical reason for using subjects with fasting blood sugar level of 5.5 mmol/l?

Answer: The study required that you use a non-diabetic patient. Hence I used one with FBS 5.5

Comment: **Dr. F.K Amagloh**

- Could you repeat the glycemic index study as rice has a high glycemic index?

Answer:

- The value for the glycemic index could be due to the groundnut soup complementation.

Question: **Dr. Nestor K Kouassi**

- Gender disaggregation data was missing. It would be more interesting if the results were presented according to gender.

Answer:

- Noted.

Comment: **Francis Alacho**

- The three dishes are all with different sources and hence difficult to compare.

Nutritional composition and diversification of the use *Dioscorea rotundata* varieties in Fako Division of Cameroon (Presented by *Ufuan Achidi)*

D. rotundata was presented as the most popular species grown in the South Western Region of Cameroon. The five common local varieties in the region are *Egbe, Aga, Muyuka, Batoke* and *Sandpaper.* The estimated production of yam was 87, 581 tonnes over 5,014 hectares. There was limited information on the nutritional value and ways of transformation of these white yams.

The objective of the study was to assess the nutrient content and diversified use of *D. rotundata* varieties in the SWR of Cameroon through processing into locally made products consumed in neighbouring countries (‘*amala’* and ‘pounded yam’).

Question: **Prof. W. A. Plahar**

- Which of the varieties of D. rotundata did you use in comparing the acceptability of the two food products?

Answer: All the five local genotypes were used for the study.

Physical and Functional properties of fermented cassava flour ('Lafun') obtained from different markets in Southwest Nigeria. (Presented by *Adebayo-Oyeforo*)

The presenter gave an overview of the nutritional composition of cassava and its distribution in the region. The production challenges included high perishability, bulkiness and presence of cyanogenic glucoside. The processing and consumption of cassava into 'lafun' was saddled with challenges including poor safety management and toxicity from consuming this product.

The objective of the study was to assess the quality status, physical and functional properties of fermented cassava flour from Ogun and Oyo state, Nigeria,

Question: **Dr. F.K. Amagloh**

- Did you suggest hygienic ways of processing the cassava flour?

Answer: Yes, I did. We advised the processors on the hygienic manner of processing the cassava flour.

Retention of beta-carotene in cream-fleshed sweetpotato- based complementary food stored in different containers under simulated tropical temperature and humidity (Presented by *Amagloh F.K*.)

The presenter mentioned the consequences of vitamin A deficiencies in children and the role orange fleshed sweetpotato can play to overcome this health problem. The objective of the study was to develop a complementary food blend of cream-fleshed sweetpotato, soyabean, oil, fish and powdered/skimmed milk as alternative to maize-soyabean-groundnut blend (Weanimix) for the ordinary household.

Question: **Dr. J.N. Berchie**

- Please in trying to compare sweetpotato complementary food and weanimix, did you consider the fibre content of the two food products and the implication in food utilisation?

Answer: Results show that sweetpotato complementary food contains higher fibre than the weanimix.

Question: **Abena Achiaa Boakye**

- Is the orange fleshed sweetpotato readily available on the Ghanaian market?

Answer: There is a challenge with its availability on some Ghanaian markets especially Ashanti region but breeders in CSIR are working on that.

Question: **Charity Sabeng Poku**

- What specifically is a good moisture barrier container for COMFA?
- Labelled pictures of sample containers should be added next time

Answer:

- Paint containers and blue band margarine containers
- Comment noted.

A multivariate analysis of the relationship between quality of sweetpotato flour ('elubo') and sensory properties of paste ('amala') (Yinka Fetuga)

The presenter indicated that the utilization of sweet potato (SP) for flour ('elubo') and cooked paste ('amala') requires the adherence to food quality standards and specific quality requirements for using sweet potato flour for different products. Commercial production of sweet potato 'elubo' and its 'amala' will require quality control and the understanding of the relationship between the varied quality parameters of flour ('elubo') and sensory properties of sweetpotato 'amala. The objective of the study was to determine the specific quality index of SP flour ('elubo') that could be used to predict the consumer acceptability of SP 'amala'

Comment: **Dr. F.K. Amagloh**

- Linear regression needs to be considered for this study.

Answer:

- Comment noted.

Comment: **Ingr. Adekola Adegoke**

- There is no need to de-emphasize the name 'amala' as suggested. What you get as paste from the flour is 'amala'. There are different pastes from yam, cassava. Plantain etc.

Answer:

- Communities where the paste are processed call it 'amala'

Effects of sodium meta-bisulphite and blanching pre-treatments on the quality characteristics of yam bean (*Pachyrhizus erosus*) flour (By Evelyn Buckman)

The presenter indicated that out of the five species, three are cultivated. The crop has a high nutritive value as a source of insulin, vitamin c and B-complex groups and good quality starch with unique physicochemical properties. The limited information on the wider uses of yam bean and the processing and preservation of yam bean flour has not been extensively investigated in Ghana. Developing and establishing the quality characteristics of shelf-stable flour for yam bean will facilitate the development of acceptable recipes. The objective of the study was to determine the effects of sodium meta-bisulphite and blanching pre-treatments on the quality characteristics of shelf-stable yam bean (*Pachyrhizus erosus*) flour.

Question: **Chijoke Ugo**

- What variety were you dealing with and does it have the hard to cook problem?

Answer:

- The varieties are Latin America yam bean.
- The work was not focused on cooking properties but on flour preparation

Question: **Dr. Pearl Adu-Amankwa**

- Why did you settle on the concentration of 0.1% sodium meta-bisulphite?

Answer:

- It was recommendation from other works.

Question: **Eric Kuuna Dery**

- Why did you use meta-bisulphite since it is assumed that it poses health hazard?
- Why didn't you measure browning index?

Answer:

- No known health hazard with meta-bisulphite was observed.
- No natural antibrowning agents in the industries have been identified.

Comment: **Dr. Ted Carey**

- Yam-bean is not well known in West Africa. The question was asked about African yam-bean. Yam-bean actually doesn't get soft during cooking but remains crunchy like water chestnut.

Comment: **Ezeocha Chincho**

- I suggest that it will be better to try some natural measures such as blanching and processing immediately after harvest instead of using sodium bisulphite.

The use of yam bean (*Pachyrhizus erosus* var EC KEW) storage root in African giant snail (*Achatina achatina*) feeding in Benin (By Pomalegni S.C.B.)

The presenter indicated that mini-livestock was the breeding of unconventional animals such as edible insects, snails, grasscutter, etc. The few resources required in mini-livestock make it common in rural and urban communities in Benin. The need for strategies and alternative feeding ingredients need to be explored to enhance the productivity of these unconventional livestock. The objective of the study was to investigate different yam bean formulations for high productivity in snail farming.

Question:

- Is there a correlation between shell size and meat content of the snail?

Answer:

- Yes, there is a positive correlation between the shell size and meat content.

Question: **Chijioke Ugo**

- Why rule out ratio 76 if it enhances the laying potential of snails?

Answer:

- The focus of the work did not cover the reproduction aspects of the snail and therefore could not give that recommendation. Suggestions are that the two ratios of 46 and 76 should be recommended depending on what the snail producer has in mind.

Comment: **Dr. Pearl Adu-Amankwa**

- Commercial snail production is basically fattening of the snail so you don't need to start from eggs. It takes between 12- 16 weeks to fatten the small sized snails.

Nutritive value of four cassava varieties and their effects in broiler rations (Presented by *Tewe O.O.*)

The presenter indicated that dietary energy constitutes a major challenge facing the Nigerian poultry industry. Use of cassava could be profitable. Dustiness, presence of cyanogenic glucosides and other microbial toxins were some of the limitations of cassava utilization in poultry feeding. Cassava grit, gelatinized product, has been utilized successfully in poultry rations without the limitations of dustiness, cyanide and microbial toxicity. The objective of the study was to investigate four different cassava varieties for their nutritive value for broiler rations.

Question: **Dr J. T. Sheriff**

- Does the HCN level drop if you peel the cassava?

Answer: Yes it does.

The effect of chemical preservatives on the quality of mushroom (*Pleurotus ostreatus*) from cassava peels (Presented by *Oluto I.O.*)

The presenter indicated that solid waste from cassava processing constitutes 30% by weight with 15% of it as peels. The conversion of these wastes into a high value product like mushroom will positively alter the dynamics of cassava processing. Mushrooms are high respiring organisms which deteriorate after harvest if appropriate measures are not taken. Changes in taste, colour, microbial load and texture leads to poor quality. The objective of this research was to assess the effect of different chemical preservatives at varied concentrations on the quality of cassava peels mushroom.

Question: **Keith Tomlins**

- How widely consumed are mushrooms in Nigeria?

Answer: They are consumed in certain parts of the country.

Question: **Alamu Oladeji**

- What are the effects of different chemical preservatives used on the nutritional value of mushrooms?

Comment: My suggestion is that this could be monitored or be part of recommendation.

Microbiological assessment of dried mushrooms in different packaging materials (Presented by *Ajayi O.A.*)

The peels and pulp of processed cassava are regarded as solid and liquid waste. Cassava wastes transformation can create marketable value-added products such fresh mushrooms. The thin and porous epidermal structure of mushrooms makes them to have a high respiration rate making them perishable and tend to lose quality right after harvest. Mushrooms are eaten raw or cooked and therefore needs be free from microbiological contamination. The objective of the research was aimed at assessing the microbiological status of dried mushroom from cassava waste in different packaging materials.

Question: **Dr. Achidi A.U.**

- Are mushrooms really eaten raw?

Answer: Yes. It is recorded in literature as fresh vegetable.

Comment: **Adekoyeni O.**

- The thickness of the packaging material has to be indicated.
- The ambient temperature for the research should be well defined.

Microbial and quality assessment of fresh mushroom (*Pleurotus ostreatus*) from cassava peels (Presented by *Obadina A.O.*)

The presenter mentioned the increasing and efficient use of cassava peels for the cultivation of mushroom.Efforts are continuously geared towards reducing environmental pollution and increasing the income generating potential of small holder cassava famers. Hence the cultivation of mushroom from cassava wastes will have positive impact. The objective of the project was to use cassava peels as substrate to cultivate mushroom and evaluate its quality and safety.

Question: **Adekoyeni Oludome**

- Don't you think the environment of cultivation constitute more of a problem as a source of microbial contamination?

Answer: A controlled environment was used for the investigation

Comment: **Dr. Achidi A.U. and Prof. Sanni Lateef**

- Is it good to check the toxicity of mushrooms with respect to chemical toxins in addition to microbial contamination?

Answer: Currently, work is on-going to get toxin free mushrooms.

Analysis of opportunities for improving the efficiency of Ghanaian cassava processing industries through introduction of selected Indian technologies (Presented by *T.J. Sheriff*)

The presenter stated the cassava producing states in India. Ghana ranked sixth globally, producing about 14.5 million tonnes over 0.9 million hectares. It is estimated that 3.7 million tonnes of surplus tubers are available for industrial utilisation. Ghanaian cassava processing industries produce chips, flour (*Kokonte Lafu*), fermented flour and cassava-corn mix flour (*Banku* mix), wet cassava cake, cassava starch and beer.

Question: **Abena Achiaa Boakye**

From the interaction with locals did you identify any local materials that could be used to enhance the Ghanaian technology instead of introducing a new technology for efficiency? Was there any cost analysis done to estimate the cost to produce from use of technology and how affordable that will be to the locals?

Answer: Existing technology in Ghana is mostly for low scale production. There is the need to scale-up thus the importance to introduce new technology. Yes, the use of new technology will be costly but very profitable in the long term.

No answer was given whether any local materials were identified

Question: **Eric Kuuna Dery**

What is the cost of maintaining the technology?

Answer: It is mechanical equipment and can be easily repaired when it breaks down

Question: **Dr. J.N. Berchie**

In India, how is cassava utilized apart from commercial utilization?

Answer: Cassava is mainly for commercial purposes.

Pre-storage curing and Nano-biotechnology treatments of fresh yam (*Dioscorea rotundata*) tuber in storage (Presented by *Simon Eze*)

The presenter indicated that the major problem of full utilization of yam was Postharvest storage spoilage. The spoilage could be caused by pathological, physiological or mechanical factors. According to him microbial attack accounts for most of the losses. Curing of yams before storage reduce the extent of losses and use of chemicals have been effective but may have associated residue toxicity problems. In view of this, the use of Nano particles holds great potentials for food preservation due to its antibacterial and anti-fungal properties. The study therefore sought to investigate the potential of bio-nanotechnology and optimum period for curing to reduce postharvest losses in yam storage.

Question: **Dr. S.O. Kareem**
Can neem leaf extract be sufficient for yam treatment?

Answer: Satisfactory.

Question: **Dr. J.N.L. Lamptey**
The 40% rot incidence on the stored yams was quite high and worrying because effect of pathogen on stored yams is a major constraint. What rot causing organisms did you isolate?

Answer: Yes. Further investigation would be done to reduce the percent rot. I did not look into the type of rot causing organism.

Processing of yellow-fleshed based cassava salad cream: carotenoid content optimization (Presented by *Chijioke, U.*)

The presenter indicated that yellow fleshed cassava varieties have been bred as a means of overcoming vitamin A deficiencies in some cassava producing countries. These varieties are processed into indigenous foods as well as value- added products like salad cream. Unfortunately most of the pro-vitamin A content in the roots are lost during processing, thereby affecting nutritive value of the end product. The presenter intimated that, during starch processing of these yellow cassava varieties, carotenoids are lost. The lost carotenoids in the effluent are therefore being targeted for recovery. The objective of the study was to determine means of incorporating recovered materials as ingredient for salad cream preparation and to determine the total carotene content of salad cream produced using the method.

Question: **Dr. J.N. L. Lamptey**

- What is the final colour of your salad cream and why do you think people will prefer this product to the available commercial salad cream?

Answer: Yellow. It was much appealing and nutritionally richer than the commercial type.

Comment: **Olotu Ifeoluma**

- You have to change the flow chart
- Storage of salad cream after processing should be done when allowed to stand for two hours.

Comment: **Dr. (Mrs.) S.A. Sanni**

- Wishing you the best in your future deliveries.

Effect of processing parameters on some quality attributes of yam starch and gluten based expanded fried snack (Presented by *Akegbejo-Samsons*)

Yam starch was said to be underutilized though cheap and readily available. The processing of yam starch and gluten based expanded fried snacks was characterized by high oil content, an undesirable property. The study was therefore to determine the effect of frying temperature, frying time, moisture content and gluten level on some quality attributes (oil content, moisture, expansion, moisture content and colour change) of the expanded fried snack. She observed that increasing gluten level within the experimental range reduced oil content. Furthermore, frying temperature and gluten level affected expansion and texture while frying time significantly affected colour change.

Question/Comment. **Dr. Adekoyeni O.D.**

- On what basis do you choose your independent variables and their levels?
- It is expected that an optimization should be carried out on the experiment.

Answer:

- The independent factors were chosen because they have been reported to have effects on the product.
- The levels of variables were chosen based on trials.
- Optimization is on-going.

Chairman:

Towards the development of sweetpotato-based couscous as human food in Benin (Presented by *Wilfrid Padanou*)

The presenter mentioned the importance of sweetpotato as a food security for poor families though national agricultural development policies rarely captured it. There was also limited processing and consumption of the crop in Benin. The introduction of orange flesh varieties to local farmers has raised interest in its cultivation. The study sought to investigate and recommend the processing of the crop into couscous for rural and urban consumers. She emphasized the potential of sweetpotato being used for couscous production and giving better perspective for sweetpotato utilisation.

Question: **Dr. F. K. Amagloh**

- Have you considered the high moisture content of the OFSPs compared with the white flesh variety?

Answer:

- Yes.

Comment: **Dr. F. K. Amagloh**

- OFSP is likely to give a dark colour.
- Preferred nomenclature is that sweetpotato roots are not tubers.

Genetic analyses of cassava segregating families for heritability and genetic gain of carotene content and other agronomic traits by parent-offspring regression. (Presented by *Njoku D.N.*)

The presenter said malnutrition caused by inadequate and imbalanced diets through conventional breeding is a challenge to scientists. Presently, only three pro-vitamin A cassava varieties are released in Nigeria. The varieties released have between 6 - 8µg/g of pro-vitamin A which is not adequate to meet the HarvestPlus target of 25µg/g. There was urgent need to screen newly bred cassava genotypes at NRCRI for higher pro-vitamin A, and to meet other nutritional requirements of cassava end-users. He said there was correlation between yellow cassava varieties and pro-vitamin A.

Question: How does the new pro-Vitamin A varieties being developed relate to stem volume yield?

Answer: No work has been done in that direction.

Question: What are the levels of Vitamin A that remain in the finished products after processing?

Answer: There is some reduction in nutrition of finished products but there is substantial amount of vitamin A available in the finished products.

Question: The colours of developed varieties are related to amount of Vitamin A in the finished products. If this is the case why do we have some reduction in Vitamin A though the yellow colour still persists in the finished products?

Answer: The correlation between colour and vitamin A refers to the raw cassava but not finished products.

Question: Do you have additional funds to continue the breeding until you achieve about 25µ/g in the fresh roots?

AnsWER: Additional resources will be solicited to continue the breeding programme.

Determination of the factors of variability of the glycemic index of yam (*Discorea cayenensis*-rotundata) - (Presented by Kouassi N.K.)

One way to classify the glycemic response to various carbohydrate-containing foods is the glycemic index (GI). The GI of foods has important implications for the prevention and treatment of the major causes of morbidity and mortality in Western countries, including non-insulin-dependent diabetes, coronary heart disease and obesity. The objective of the present study was to investigate the predictability of measured GI in yam by developing prediction equation using yam components.

Question: What can you say in general concerning GI and starches from other roots compared to Yam?

Answer: The work did not compare the results with other sources of starches.

Initiatives by IITA to pre-empt cassava diseases and climate change to enhance food security in Burundi and Rwanda. (Presented by *Njukwe Emmanuel*)

The development of agriculture requires an appropriate institutional framework (legal and regulatory) and the facilitation of access to technical and financial services for the development and marketing of products. There are however challenges in Rwanda and Burundi in this area. Root and tuber crop varieties cultivated are susceptible, low yielding and of limited nutrition and market value. Cropping systems are often inappropriate with limited knowledge on integrated farming systems. Continuous cropping on small farm sizes due to high population density resulting in highly degraded soils. Farmers have limited savings to reinvest in agriculture

and need credit facilities. There is the need for synergy among technical services, including research, extension, NGOs and farmers.

IITA's interventions/achievements include the introduction of improved cassava varieties resistant to pests/diseases and climate change with high nutritional value, establishment of community-based cassava processing centers, generation and promotion of better crop management technologies, establishment of community-based seed systems, and training of scientists and technicians who are contributing to the national research program.

Question: How do you eradicate diseases already in the field as well as preventing movement of planting materials?

Answer: There is a plant quarantine department in place to check this. There are however challenges in this direction which are gradually being addressed.

Question: At what point can we say cassava is high in β-carotene?

Answer: This is debatable but for now we can say once we have appreciable amount of β-carotene compared to local varieties before breeding, we can say they have hi β-carotene until definite criteria are set for defining the levels.

Question: Why did you refer to export market as having low potential for cassava products?

Answer: The current product qualities could not allow the finished products to penetrate the export market since the processing methods are of sub-standard.

Towards the Development of Cryopreservation protocols for *Solenostemon rotundifolius*: Impact of pre-treatment. (Presented by *Quain M.D.*)

Plant germplasm represents the storehouse of genetic diversity necessary for the conservation and utilization of genetic resources. Frafra potato (*Solenostemon rotundifolius*) also known locally as Hausa potato is indigenous to tropical Africa and a food security in the Sub-Sahelian region. It also has an essential role as a medicinal plant and is used in the treatment of dysentery and eye disorders. Storage of biological material at ultra-low temperatures, preferably that of liquid nitrogen, arrests all metabolic activities: consequently, no genetic changes should occur, theoretically, permitting indefinite germplasm storage periods. *Solenostemon rotundifolius* is hyperhydric and hence difficult to cryopreserve. Mannitol treated tissues were more desiccation tolerant than sucrose treated tissues although other reports have successfully used sucrose to induce dehydration tolerance. There was the need for further investigation towards development of cryopreservation protocol.

Question: Was there any modification in the cryopreservation?

Answer: Yes there was with the use of other chemicals.

Question: How would you marry your research with what the farmers have been doing in order to help the farmers?

Answer: The farmers were involved with the work and the knowledge tapped from them was factored into the work.

New approaches for root and tuber genetic resources conservation and use. (Presented by *Gueye Badara*)

Cassava and yam play an important role in food security in sub-Saharan Africa. However, their production was still constraint by many factors such as scarcity of planting materials, pests and diseases. Therefore the cultivation of cassava and yam needs more attention in terms of genetic resources collection and their use to support crop improvement programs. The presenter stressed the point of joint working approach between Genetic Resources Centres and breeding teams.

Question: **Dr. Leke Walter**

Which are the "new" approaches for root and tuber genetic resources conservations and uses?

Answer: Working together with other specialists to make this happen

Comment: **Njukwe Emmanuel**

Number of cassava assertions in GRC has to be kept and in high number because farmers criteria for cassava variety preferences is wide.

Question: **Dr. J.N.L. Lamptey**

When you say "improved cassava varieties are resistant to climatic change", what do you mean?

Answer: I mean they are drought resistant.

Question: **Iyangbe Charles**

Who should be promoting the visibility of gene bank?

Answer: All stake holders.

Comment: **Dr. G.C. Orkwor**

The only way to improve germplasm conservation was to go back to the decisions taken by PGRI, CORAF, Food Research Institute, CGIAR and NARS in Sali Portuday, Senegal, Ouagadougou, IITA on establishment of centers of excellence on germplasm.

Farmers' methods of evaluating cassava varieties in tropical climate conditions of western Kenya. (Presented by *Woyengo Vincent*)

Cassava grown for subsistence was 60% in western Kenya. There were however different production and utilization of the crop between region/community. There is the need for PVS. Success of the PVS depends on the effectiveness of farmers' methods of variety evaluation. Farmers use ITK and there was the need to understand these methods and effectiveness of the ITK used. The significant differences in variety ranking and scoring of traits between districts indicate differences in preferences hence need for decentralized PVS. Thus farmers-scientist collaboration in variety evaluation was essentially needed.

Question: **Chipuvay**

What is the implication in terms of resources if breeding is to respond to District requirements?

Answer: The local government could intervene.

Chairman: Dr. Regina Sagoe

Price integration analysis of some selected cassava root markets in south eastern Nigeria. (Presented by *Anyaegbunam et al.)*

The presenter highlighted the importance of cassava for national growth and how the absence of agro industrial markets remains the major constraint for the development of the crop. The objectives of the study were to analyze the price integration of selected cassava root markets and also determine problems faced by marketers. The authors concluded that cassava markets were spatially separated but prices in the study area were not integrated. There were many problems faced by the marketers which hinged on poor market access and inadequate infrastructural facilities. Policy geared towards providing these facilities will enhance marketing activities in south eastern Nigeria.

Question: **Joseph Rusike**
Analysis conducted was for fresh roots cassava. There was therefore the need to take seasonality into account of the production and movement of cassava roots.

Answer: Correlation of the fresh roots and its physical movement would be done later for a clearer picture.

Question: **Iruansi Itoandon**
What informed the selection of the locations and what are the factors responsible for the non-integration of the locations in South East Nigeria.

Answer: Sites were randomly selected in the states of South East Nigeria.

Question: **Dr. Regina Sagoe**
Your presentation did not give a recommendation, although you listed some drivers

Answer: The drivers as indicated in the presentations are to assist us all to make recommendations for the way forward on all the issues raised.

Community analysis of root and tuber crops farming system in South Eastern Nigeria (Presented by *Asumugha, G. N.*)

The importance of yam, cocoyam, cassava and sweetpotatoes as food security crops was mentioned. Many of the poorest farmers and food insecure people were highly dependent on these crops as principal sources of food, nutrition, and cash income. The study objective was to do analysis of root and tuber cropping systems in a community in South Eastern Nigeria. The general problems facing farmers were the land tenure system (fragmentation of holdings), inadequate inputs- fertilizer, pests and diseases – Yam beetles, cassava brown streak, cocoyam leaf blight, sweetpotato weevils, inadequate supply of improved varieties, high labor cost, lack of modern farming equipment, lack of access roads to farms, lack of storage facilities at harvest and capital.

Question: **Charles Lyanpse**
Why was there no detailed analysis to identify key factors that contributes to price disintegration among markets in Abia and Enugu?

Answer: Such analysis has been done in the past and this study brings out further information in the two selected locations.

Gender surprises in cassava production and processing among farmers in Abia State; the case of adopted village project. (Presented by *Ekedo et al.)*

The concept of Adopted Villages project was presented as a rural agricultural transformation project initiated by the National Root Crops Research Institute (NRCRI) Umudike at the directives of Agricultural Research Council of Nigeria. It is a pilot project that has been designed to facilitate the transfer of agricultural technologies developed by research institutions, universities and colleges of Agriculture to farmers and students. The objective was to highlight the prevailing surprises encountered in the study of gender roles in cassava processing and production activities among farmers in adopted village project communities in Abia State, Nigeria. Greater proportion of males indicating constraints as inadequate funding (92%), inadequate planting materials (76%), high cost of labour (84%) was more as against 76%, 72% and 76% proportions of women.

Question: **J. Rusies**
What is the source of discrimination between males and females with respect to access to resources, participation and distribution of incomes?

Answer: Gender surprise is what the study found out, in that roles which were purposely for women are now been taken over by men.

Question: **Charles Lyangse**
How do we resolve the issue relating to fragmentation of land? Why is the government limiting its effort just only to fertilizer neglecting herbicides and other agriculture inputs?

Answer: The issue of land is very sensitive in every part of the country. Farmers' lands are often property inherited and cannot be forcefully collected from them. What needs to be done is to encourage farmers to come together and produce commercially.

Chairman: Dr. A. Adu-Dapaah

Impact on taro leaf blight on supply response of cocoyam in Nigeria: Implications for cocoyam trade. (Presented by *Okoye Benjamin)*

Cocoyam is an important staple food throughout the world. Production of cocoyam has however not been given priority attention in many countries probably because of its inability to earn foreign exchange and its unacceptability by the high income countries for both consumption and other purposes. The demand for cocoyam exceeds the domestic supply and there appears to be a deceleration in the growth potential of cocoyam from 2009 probably because of the devastating effect of Taro Leaf Blight in Nigeria. Taro leaf blight (TLB) caused by

Phythophtora colocasie is a new disease of *Colocasia spp* observed in Nigeria in 2009. The spread of TLB is greatly enhanced by high relative humidity as a result of increase in rainfall between the months of August and September. Cocoyam production in Nigeria has drastically declined by about 60%. Preliminary investigation has shown that the epidemic was caused by TLB. Total crop loss due to this disease is now of common occurrence in Nigeria. Yield losses is up to 50% in severe cases and 70% in extremely severe cases

Question: **Njukwe Emmanuel**

What is the short term intervention strategy to control taro leaf blight because chemical control is not cost effective/environmentally effective?

Answer: The use of fungicides.

Question: **Dr. Leke Walter**

Why do you interchange taro with cocoyam because the TLBD is associated with taro. How effective is the use of fungicide to control TLBD?

Answer: Cocoyams are generally used for taro in cocoyam and taro in Nigeria but meant taro in this presentation. The effectiveness of fungicide used to control the disease is not documented.

Comment: Since the publication is international, the presenter was advised to stick to the scientific names of cocoyam and taro to avoid the confusion in his presentation.

Question: At what stage is the fungicide applied to the crop?

Answer: The moment one or two leaves of the plants are spotted with TLB disease on the field.

Question: Have farmers tried to overcome this problem and how are they doing it?

Answer: The next line of the research is directed in this area.

Constraint analysis of farmers' adoption of sweet potato utilization technologies in Southeast agro-ecological zone of Nigeria. (Presented by *Jane Nwaekpe*)

Sweet potato (*Ipomoea batatas (L*) Lam) is one of the most important staple carbohydrate foods in sub-Saharan Africa. Sweet potato can be processed into Sparri ('sweet potato garri'), Flour, Confectionaries such as buns and cakes, Crisp, Canned Sweet potato, Animal feed, Starch, Sweet

potato Beer, Sweet potato Beverage *(kunu, burukutu)*, chips, starch, noodles, alcohols, medicinal syrup, culture media. There is therefore, the need to assess the level of awareness and adoption of sweet potato utilization technology and the constraints against the adoption of this technology.

Question: **Imegwu Christopher Nwamdi**

What is the cause of the ineffective method of communication which you mentioned as constraint to farmers adoption of technologies and what is your institution doing about it?

Answer: The extension services pathway was not very effective. Efforts are being made to correct the anomalies by using new methods.

Question: **Ezema Raymond**

How representative was your sample size?

Answer: It was limited by resources.

Question: **Ejukwe Emmanuel**

Sweet potato tolerates adverse weather condition but in Rwanda and Burundi, it is cultivated in Swampy areas. More respondents are males; does it mean men are more involved in sweet potato commercialization?

Answer: Potato is grown in specified locations not necessarily in swampy areas in Nigeria and both men and women are involved in the commercialization.

Potential for commercialization of cassava production in Mpumalanga province of South Africa. (Presented by *Molemi Rauwane*)

Cassava is a resilient crop that can grow and produce high yields in areas which are not suitable for the cultivation of cereal crops. Cassava is however cultivated as a supplementary crop in South Africa. Cassava has been neglected by the scientific, industrial and legislative sectors and is thus considered an “orphan crop” in South Africa. A survey was conducted on cassava cultivation in the Mpumalanga province of South Africa seeking to elucidate farming systems as well as the nature and purpose of cultivating cassava. The crop’s full potential in South Africa needs to be fully exploited.

Question: What is the average yield of cassava in South Africa?

Answer: There is no data on this at the moment because it is not a stable crop. The study is a PhD work and shall look at it.

Question: **Patricia Acheampong**

I think the sample size of 30 is too small for conclusions to be drawn.

Answer: The survey is still on going to cover more farmers.

Comment: **Njukwe Emmanuel**

The topic needs to be modified or extensive market analysis need to be carried out. The presenter should discuss her work with participants from Ghana and Nigeria since these countries have done much work in the area.

Chairman: Peter Kaindanch

Farmers perceived adoption risks associated with Nicola variety of potatoes in Jos Plateau Nigeria. (Presented by *Ekwe* et al.)

The importance of potato in the world and among farmers in the Jos Plateau, Nigeria was highlighted in the presentation. Among the potato farmers, varieties such as the Nicola, WC 785-2, Kondor, Diamant, Desire, 377865-35, WC 732-1 were popular. The study examined farmer perception of the Nicola improved potato variety as well. The Nicola variety of potato despite its promising attributes has limited adoption level. Its use among farmers was being compromised by certain risk factors. From farmers' perception High initial cost of adoption, low resistant to drought, high field loss due to high susceptibility to disease and pest as well as theft of the tubers at harvest time pose certain risks to adoption of the Nicola variety.

Question: **Patricia Acheampong**
Sample size is too small for any meaningful conclusion. What are the serious and unserious perceptions in your presentations?

Answer: The sample size would be looked at in subsequent studies. The serious and unserious perceptions are basically the perceptions of the farmers.

Question: **Charles Iyangbe**
The sample number in your study is too small, why:

Answer: As indicated in the previously answer, the sample size would be looked at in subsequent studies.

Socio-economic analysis of yam bean (Pachrhizus erossus) processing to gari in Benin. (Presented by *Prosper Houessionon*)

The ability to process yam bean (Pachyrhizus erosus) into gari was enumerated. Yam bean is nutritious and has good agronomic features and it's gari is better than cassava gari on vitamins. The objective was to analysis the financial profitability of yam gari. *P. erosus* gari can be processed. Additionally, producers and consumers have a good perception of this product. The study showed that *P. erosus* gari yield increases, improves producers gain, reduces cost price per unit (340 F CFA to 261.50 F CFA) and allows its spreading on markets.

Question: **Joyce Haleegoah**
The crop is an introductory crop. How is the preference of the product, is it just the few people who prefer it. Have there been some consumer preference studies.

Answer: Baseline studies on preferences have been conducted however not elaborate.

Question: **Joyce Haleegoah**
The calculation of probability is Mse % difference instead of absolute values.

Answer I will look at the equation on probability again.

Transformation through integrated Agricultural research for development (IAR4D): experiences from cassava value chain innovation platform-DONATA Project, Ghana. (Presented by *Bolfrey-Arku et al*.)

Cassava as a major food security crop was presented. Challenges bedeviling the cassava industry were highlighted. The object of the paper was to transfer and disseminate improved technologies along the cassava chain (production – marketing), exchange and share indigenous knowledge and practices among various stakeholders, foster strong collaboration and trust among stakeholders and enhance skills and knowledge. Access to 5 other improved varieties (Nkabom, Ampong, Otuhia, Bronibankye, Esambankye) besides Bankyehemaa and IFAD had been achieved . Direct beneficiaries of 190 (75 M, 115 F) in 5 platforms cropping over 50 ha and 111 indirect beneficiaries has been achieved. Among others, there was a 70% increase in use of herbicide use by farmers and Glyphosate application rate reduced by 60% (10 L/ha to 4 L/ha).

Question: **Regina Sagoe**
How different is this innovation platform from the Adopted village concept by our colleagues from Nigeria.

Answer: The concept is similar as it brings together at least two actors of the value chain of a commodity and is linked to markets as well.

Question: **A. Adjoa**
What are the bottlenecks to the uptake of good management practices?

Answer: The understanding of commodity actors often resolves management challenges.

Question: **A. Adjoa**
What are the challenges of the fabricators towards meeting the needs of processors?

Answer: Capital for fabrication to meet their needs.

Farmers' evaluations of Cassava variety traits in southern Ghana: the Mixed Logit Approach (Presented by *Acheampong et al*.)

Cassava was identified as a potential remedial crop for tropical smallholder farmers due to its high productivity and low input requirements. Despite its food security role, the national average yield of cassava was about 14t/ha although over 47 t/ha is achievable. The objective of the study was to identify cassava variety traits preferred by farmers, analyze farm households' characteristics and demand for cassava variety traits and to determine farmers' willingness to pay (WTP)(Valuations) for cassava variety traits. Results revealed that preference heterogeneity exist in the sample population. Farm households have high preference towards in-soil storage and disease resistance attribute. Productivity and producer price attributes are only weakly preferred by farm households. Extension contact, gender, experience and age are the socioeconomic factors that affect demand for cassava variety traits.

Question: **Joyce Haleegoah**
What was the problem in getting the women involved?

Answer: Women were involved as indicated by 40%. This is acceptable as it conforms to the participation of most projects.

Question: **Grace Bolfey-Arku**
Please, define your unit for willingness to pay for in-storage. Is the unit one day, three months or six months?

Answer: That is accepted, willingness is considered in the present work.

Question: **Regina Sagoe**
Does gender has a positive impact on the two variables of preference discussed in your presentations?

Answer: Gender is important issue and included both men and women. However in the study more emphasis was placed on women to represent the gender variable which had preference.

Chairman: Dr. J. Asafu-Agyei

Pasting properties of flours from high-dry matter sweet potato (impomea batatas) varieties: the influence of crop maturity. (Presented by *Adu-Kwarteng E*.)

Sweetpotato is among the top 3 food sources of potassium. It is also a rich source of various anti-oxidant, anti-inflammatory and anti-mutagenic compounds. Some cultivars have recently been classified as antidiabetic food – offering protection against insulin resistance. In West Africa, products such as sweetpotato 'gari', 'fufu', crispy chips [from fresh roots] and pastries [from composite flours] have been demonstrated. Sweetpotato yoghurt, salad cream, baby food, pancake and breakfast mixes have also been developed in Ghana. In spite of these attributes it has faced persistent low utilization over the years, especially in Ghana and some parts of West Africa. The aim of this work was to investigate the influence of crop maturity on processing characteristics of four (4) sweetpotato cultivars.

Comment: **Abass A.B.**

Since sweet potato is a source of amylase enzyme, it can be used as means of reducing the viscosity of cassava based foods in localities where viscosity is not desired in foods and other food products.

Question: **Dr. K.C. Ekwe**

One expected that you recommend the optimal harvesting time of sweet potato varieties for specific products but this was not done.

Answer: Recommendations were done based on specific varieties that have similar results.

Question: **Dr. J. Asafo-Agyei**

What is the ideal harvesting time for potato varieties studied if one does not want relatively too sweet potato products?

Answer: The ideal time is four (4) months maturity date and the potato must be used immediately after harvest.

Question: **Gregory A. Komlaga**

Which of the potato varieties studied had the highest amylase activity and did you make any reference to literature concerning earlier work?

Answer: Yes reference was made to Dziedzoave *et al* but amylase activity was not determined due to expensive nature of analytical kits.

Design and performance evaluation of an agricultural waste-heated cabinet dryer for cassava processing. (Presented by *Alenkhe B.*)

The use of cabinet dryers is well known but their use is hindered by limited sources of energy which are mostly uneconomical for resource poor farmers due to the high costs. A cabinet dryer heated with agricultural wastes such as saw dust, palm kernel shell and cashew nut shells was investigated. Design considerations were: low cost, equal heat distribution in the dryer, consistent quality of dried products. The work is in progress and areas of further investigation include use of other agricultural waste with higher specific heat capacity (palm kernel shell and cashew nut shell) and effective circulation of heat in the drying chamber.

Question: **Godwin Asumuga**

What is the efficiency of the dryer compared to a flash dryer?

Answer: The efficiency of the dryer cannot be compared with the flash dryer but effective for drying. More work is on-going to perfect the dryer.

Comment: **Charles Iyangbe**

There is the need for detailed economic analysis on the dryer to determine viability and efficiency.

Question: **Dr. B.C. Okoye**

What is the effect of wood tar on the material that is dried?

Answer: There is no effect because the hot air for drying does not have direct contact with the source of the heat. The heat is channeled through a capillary tube and the fresh air which carries the heat for drying blow on the surface of the tube for heat exchange.

Analysis of the factors influencing sweet potato in South Eastern Nigeria. (Presented by *Igwe Clara*)

The primary objective of every sweet potato producer includes profit maximization, cost minimization and the maximization of satisfaction or combination of all these. The inputs required for its production are not costly when compared to other root and tuber crops. Within the root crop belt of Nigeria especially south east agro-ecological zone, sweet potato has joined the league of life saving crop such as cassava. Small holder farmers have renewed interest in sweet potato production because of its low gestation period of 3-4months, tolerance to wide ecology and use as a cover crop to suppress weed growth. In spite of the potentials of sweet potato production, the crop is still regarded as a minor crop in the south eastern Nigeria, ranking behind the other root crops. It is grown primarily for human consumption but the current production status in South Eastern Nigeria is not encouraging, hence the need to analyze the factors affecting sweet potato production in southeastern Nigeria.

Question: **Ndiriowe Jeon**

How did you cost the planting material in your study?

Answer: The planting materials are mostly bought in bundles for cultivation.

Question: **Patricia Acheampong**

How was the yield measurements taken? The yields might have inflated the profit.

Answer: They were surveyed.

Question: **Abass A.B.**

What is RRI and how is it better than IRR in evaluating the profitability of an enterprise?

Answer: RRI is Rate of Return Index. I do not have an idea about how it is different from IRR but will find out.

Question: **Charles Iyangbe**

What do you mean when you say some of the variables have negative influence on profitability?

Answer: This means that the factors are not favourable to farmers to invest in sweet potato.

Responsiveness of farmers to root crops technologies disseminated through mass contact channels in Abia State. (Presented by *Ekwe K.C.*)

Use of mass contacts channels (MCC) for the dissemination of agricultural information emerged out of the need to reach largest number of farmers possible in a shorter time period. MCC involves the use of Radio, TV, Exhibition, publications, training workshops, extension guides etc. In recent past years, increased efforts have been made by NRCRI to promote, popularize and accelerate the dissemination root and tuber crops technologies through several mass contact channels. It is therefore appropriate to capture the responses of farmers to the technologies disseminated to them through the MCC.

Comment: **Abass A.B.**

We must be careful in attributing long list of technologies developed and used by farmers in Nigeria to only one research institute.

Question: **Joyce Haleegoah**

Was the radio publicity done on government owned radio stations or on private ones? I ask because I want to know who pays for the programmes.

Answer: The programme were aired on both public and private radio stations and all whether on private or public radio station were paid for by the project.

Comment: **Patricia Acheampong**

Policy implications must be stated clearly at the end of every socioeconomic study. These were not being done in some of the studies presented at the symposium.

Chairman: Dr. Pearl Adu-Amankwa

Priorities for research of a global cassava program in sub-Sahara Africa; perspectives of scientist and farmers. (Presented by *Rusike et al*.)

The debates whether or not NARS should depend on centralized priority setting of CGIAR global programs or own decentralized approaches is of importance to all actors of the value chain. According to the presenter the objectives of the study was to analyse rankings of constraints using qualitative survey data from experts and farmers, determine latent classes for rankings controlling for heterogeneity in responses and finally identify priorities for a global program for cassava. In conclusion, it is difficult to set priorities for SSA, data available for rankings of

constraints by experts and households on commonalities such as diseases/pests, planting materials, breeding, genetic, agronomy, and soil fertility. Finally, overlap in top-ranked constraints is required for global approach for commonalities.

Comment: **Godwin Asumuga**
Priorities for global cassava program should not be based on the commodities identified but to be based on peculiarities of each country to be identified on the country's value chain.

Answer: This study concentrated on experts such as breeders, agronomist etc across the countries and the finding of their priorities would definitely shift when farmers responds to this survey.

Comment: **Barima James**
If you are a donor with access to baseline data, Priorities for global cassava program should not be based on the commodities identified but to be based on peculiarities of each country to be identified on the country's value chain

Reaction: This study concentrated on experts such as breeders, agronomist etc across the countries and the finding of their priorities would definitely shift when farmers responds to this survey.

Question: **J. B. A. Whyte**
There are three levels of development of cassava value chain
Level 1: Those at that level requiring planting materials
Level 2: Those at the level requiring disease
Level 3: Those at the level requiring markets
Which level are for the various countries studied?

Answer: All the various levels have been addressed by the study.

Haematological and serum biochemical indices of Japanese quails (*Coturnix cotumix* japonica) fed cassava grits as replacement for maize with or without β-glucanase (Presented by *Amosun et al*.)

The presenter gave an overview of the use of cassava in animal feed. The importance of cassava replacing maize in animal feed was enumerated. In the study, the objective was to replace maize with cassava with or without β-glucanase as feed for the Japanese quails. In conclusion, the processing steps for cassava grits have been successfully developed and patented as well with or without enzymes. Further studies on variants of the feed are underway.

Question: **A. A. Onunka**
What is the shelf-life of your developed product?

Answer: The product will stay for 6 weeks, but more studies will be conducted on it.

Comment: **Abass, A. B.**
The level of blood thioganate is alarming considering the small size of the bird.

Reaction: That is noted and more work will be conducted on it.

African root and tuber scale (arts) status in some local and improved cassava varieties: case of North Kivu in D.R. Congo. (Presented by *N. Eleko, K.M. Lema; R. Hanna and N.M. Mahungu*, University of Kinshasa)

The presenter talked about the importance of cassava and its role in food security and income generation. He talked about the negative effect of the African Root and Tuber Scale (ARTS) on cassava production. The results from this study revealed that ARTS negatively affects root yield (more in medium than high altitude). Improved and recently released varieties seemed to be more susceptible to ARTS than landraces. Some improved varieties showed some relative stability to their reaction to ARTS infestation.

Question: What is the influence of the nature of the soil on the infestation of the ARTS?

Answer: The pathogen is not soil borne.

Comment: The conclusion of the paper seems to contradict the earlier statements that the improved varieties were more affected by the ARTS but were higher yielding.

Answer: The improved varieties were higher yielding than the local varieties though they were more affected because they tolerated the pathogens more.

Question: Is the ART found on the cassava stem?

Answer: The ART are not found on the stem.

Question: Is the susceptibility of the improved varieties due to their high sugar content?

Answer: Rather the resistance of the local genotypes may be due to their high cyanide content not their sugar content.

In vitro inhibition of fusarium by lactic acid bacteria (lab): implication of yam disease control for economic growth in Nigeria. (Presented by *Omodamiro, R.M.*)

Question: In the procedure for the Agar well assay, did you cover the wells with another layer of softer agar?

Answer: That procedure was not used. Only one agar containing the test organism was used. The indicator broth was used.

Question: Did you do any basic test to characterize the anti-microbial compounds e.g. materials that the broth contains to see the effect produced by the acid?

Answer: That test was not done but will be done later

Question: On which species of Fusarium was the lactic acid bacteria used?

Answer: *Fusarium niganae*

Question: Good results of the inhibition properties of the Lactic acid bacteria were obtained at the laboratory. Can this be expected on the field?

Answer: It will be interesting to carry out such study hence it has been recommended.

Question: Is *Fusarium* responsible for the production of fumocin?

Answer: The focus of the study was to investigate the inhibition of post-harvest deterioration of yam not the chemical changes in the Fusarium.

Pests and Diseases Associated with Yam Bean (*Pachyrhizus erosus*) Cultivation at Farmers' Levels in the Central Region of Benin. (Presented by *A. Bouraïma, R. Sikirou, P. Y. Adégbola, A. Adjanonhoun, B. Zocli, L. Gnancadja, M. Sézolin, K. Hell, K. Ahiou, Feu P. Fandohan and G. A. Mensah*)

Pachyrhizus sp. also called yam bean is a root legume and native to Central America and South Caribbean. The objective of this work was to study the reaction of *P. erosus* to pests and diseases pressure under the agro-ecological zone of center Benin. The results from the two consecutive years, revealed that *Ootheca mutabilis, Medythia quaterna, Piezotrachelus varium, Megalurothrips sjostedti* and *Brevipalpus phoenis* were the common pests collected on *P. erosus*.

Question: What is the use of the roots of the yam bean?

Answer: The roots are the economic parts which may be used in several processed forms; fried, boiled, gari, flour, etc.

Question: If the seeds contain poisonous chemicals, how safe are the roots?

Answer: The roots are safe to eat because weevils have been found to consume them without any effect on them though the seeds have insecticidal properties

Question: Some insects were found on the yam bean leaves but there were no damages. Why?

Answer: Those insects were not pests. They have not been identified yet.

Question: Considering that there is rotenone in the seeds of *P. erosus*, how come the results showed damage to the pods?

Answer: Some of the varieties have low rotenone content hence may not be completely protected from insects.

Question: Why did you choose cowpea as the test crop?

Answer: Cowpea was used because it is noted to be attacked by several pests hence they were used as checks to investigate whether more insects will attack the yam bean than cowpea.

Field response of Pacific accessions of *Colocasia esculenta* to taro leaf blight disease in Nigeria. (Presented by *Dr. Joseph Onyeka*)

Question: Considering the high diversity of the Taro leaf blight, are you not afraid of introducing that wide diversity of the exotic strains of the TLB or have a combination of the different TLB from Asia?

Answer: Before materials are introduced into Nigeria, diagnostic tests are carried out after which phytosanitary certificates are obtained from the shipping country. The materials are then shipped as tissue culture plantlets to the recipient countries who also conduct tests to ensure that the new materials are clean. Any material found to be contaminated will be discarded.

Question: In your presentation, you indicated that you carried out some tests in Cameroun, who were your collaborators there?

Answer: Cameroun was not initially involved in the study but they were brought on board when the farmers started complaining of the appearance of the pathogen on their fields. Some of the collaborators were Amayana and Walter. IRAD was also a collaborative partner.

Question: Does the causal agent affect *Xanthosoma sp?*

Answer: No. Both screen house and field studies have shown no symptoms on *Xanthosoma sp.* However, rot which does not affect Taro is a serious problem in *Xanthosoma sp*. So there have been suggestions that hybridization should be carried out to produce hybrids that will be resistant to both the Taro Leaf blight and the *Xanthosoma sp* rot.

Question: Why did you say that some of your Taro varieties were resistant but the picture showed some disease symptoms?

Answer: The variety presented showed very low incidence of the disease.

Question: Are there any post-harvest evaluation of their susceptibility to pests and diseases?

Answer: As at now the focus is on their response to the pests and diseases. Post harvests reactions will be considered once resistant or tolerant genotypes have been identified.

Question: Some of the genotypes looked like ornamental plants (known as "elephant ear") found in Ghana. Are they really Taro?

Answer: Yes they are Taro. DNA analysis revealed that they are 100% taro. These robust and resistance genotypes were developing stolons which may not be desirable to the farmers but they are now undergoing agronomic evaluation to assess their acceptability.

Question: Are there any secondary hosts of the TLB besides taro?

Answer: The pathogen is host specific. As at now, it has not been isolated from any other host. However, the pathogen has been able to survive during the off-season indicating they might have existed either as spores or other forms.

Pests and diseases status of local and improved cassava genotypes in selected pilot sites in Cameroon (Presented by *Maurice Tindo, Emmanuel Njukwe and Abdou Tenkouano*)

Cassava has become one of the dominant starchy staples in the diet of the people since its introduction to Africa from Central and South America by the Portuguese in the 16th century.

The objective of this study was to evaluate and document potential changes following the introduction of new cassava genotypes at the project sites. The results from the study indicated that the introduction of improved cassava genotypes did not significantly affect the pest status which was rather unusual.

Question: Disease severity score was best done during rainy season. Why did you do yours in the dry season?

Answer: Considering the diseases (CBB, CMD, CAD, etc.) and pests (Mealy bugs, CGM, spiraling white-fly) involved, the dry season is the best because that is the period that the effects are severe

Question: Why did you not present quantitative data after the statistical analysis?

Answer: The data is available but for lack of time, I could have presented quantitative data.

Question: Why didn't you consider looking for pests and diseases of the roots?

Answer: They were mentioned in the presentation; root scale insects and root rots were found and were reported in the presentation accordingly.

Question: Why didn't you inoculate the fields before going to take your data?

Answer: The objective was to assess the pests and disease status of the introduced genotypes under field conditions.

Evaluation of four botanicals for the control of post-harvest tuber rot of Irish potato (*Solanum tuberosum).* (Presented by *A.O. Aduramigba-Modupe,* (University of Ibadan, Nigeria)

Irish potato (*Solanum tuberosum*) family *Solanaceae*, is one of the important crops in the world due to its high value for human nutrition. Some of the production constraints in Nigeria include: abiotic factors (poor soil fertility, high temperature, limited access to good planting materials), biotic factors (insect pests, nematodes e.g. *Meloidogyne javanicus* , viruses e.g. leaf roll virus, bacteria e.g. *Erwinia carotovora* (Potato rot), and fungi *Fusarium* rot disease, *Pythium* tuber rot disease, and *Phytophthora infestans* which causes late blight disease. The objective of this study was to isolate and identify the fungi associated with post-harvest tuber rot of Irish potato and also evaluate the efficacy of four botanicals *in vitro* and *in vivo* in the control of potato rot-causing fungi. Nine fungi spp associated with Irish potato tuber rot were isolated. *Fusarium oxysporium* had the highest frequency of occurrence in Bodija market followed by *Fusarium*

verticilloides. Fusarium verticilloides had the highest frequency of occurrence in Sabo, Abuja and Apata markets. *Fusarium verticilloides*, *Botryodiploida theobromae*, *Macrophomina* sp, *Penicillium digitatum* and *Aspergillus niger* and *Phoma sp.* were identified and found to cause tuber rot of Irish potato.

Question: What is the essence of collecting Irish potato tubers from the market instead of farmers' fields?

Answer: Farmers grow Irish potato only in the North of Nigeria hence collection from farmers' fields in Ibadan was not possible.

Question: Did you compare the effect of the botanicals and those of synthetic chemicals? I believe that would also enrich the work.

Answer: That has not been done but since the work is still at the preliminary stages, that could be considered.

Question: How long do farmers store Irish potato in Nigeria?

Answer: Farmers only harvest and send to the market for sale. They hardly store them. They keep them till they are all sold (not under any proper storage conditions).

Question: With respect to percentage inhibition of the causative agent is *M. olifeira* is active or inactive?

Answer: *M*. *olifeira* was not able to inhibit the causative agent of the Irish potato rot, thus *M. olifeira* was not considered for the isolation.

General comments: Why are scientists not investigating the active ingredients in plant extracts or botanicals and other substances used in their experiment? Could it be due to lack of facilities?

Will it not be possible for scientists to team up with other scientists in advanced laboratories for some of these procedures?

Varietal response of sweetpotato (*Ipomoea batatas*) to fertilizer regimes in different agroecologies in Nigeria. (Presented by *A.N. Onunka, M.H. Tokula, M .I .I Nwankwo and C. N. Ehisianya,* NRCRI, Nigeria*)*

Sweet potato is a herbaceous perennial plant with edible roots. It is characterised by varied morphological characteristics. It is very important in the preparation of several recipes (bread, biscuits, etc.) however, the production levels are still low. To boost production, there is the need to apply fertilizer in sweet potato cultivation. The objective of this study was to determine the fertilizer requirement of two different sweetpotato varieties (white and Orange-fleshed) in two different agro-ecological zones of Nigeria. The results showed significant differences in the performance of the two varieties of Sweet potato at the two different ecological zones tested in Nigeria. This makes it necessary to conduct crop adaptability trials in different ecologies with a view to making the right selection and recommendation on crops.

Question: What accounted for the high variance in the yield values obtained?

Answer: The wide variation could be due to error. So the experiment needs to be repeated.

Question: Are the results statistically significant among the fertilizer rates?

Answer: The results were not statistically different even though different rates of fertilizer were used.

Question: Were the soils poor enough to warrant fertilizer application in order to bring out the difference in performance?

Answer: The soils were low in soil fertility from the initial soil analysis.

Question: Did you sort out the roots into marketable and non-marketable roots?

Answer: The roots were not sorted out because every root is marketable depending on the use; those not usable by human beings can be used in animal feeding.

Question: Can you clarify the experimental design? The total number of treatments is confusing?

Answer: The experimental design used was 2 x 4 factorial in RCBD. It was made up of two varieties planted with four different levels or rates of fertilizer giving a total of 8 treatments.

Appropriate farming practices for mitigation of climate change: Case of cassava on the non-incineration of a grassy fallow forest of Kisangani. (Presented by *A.N. Ndonda, N.M. Mahungu, A.N. Frangoie*, IITA, Congo)

The causes of global warming are numerous and agricultural land use and forestry are involved in about 33% of the causes. Yield reductions due to climate change in Africa are expected to be about 30%. The objective of the study was to contribute to the fight against agricultural causes that affect climate change. The results from the study revealed that incineration or burning as a land preparation method increased the acidity of the soil. Branched cassava varieties performed better than the erect types. In the economic analysis, no incineration with tillage yielded better and was more profitable. Destruction of agro ecologies and biodiversity resulted in rapid depletion of soil. Greenhouse Gas emissions (CO_2) also contribute to climate change.

Question: Can you explain the mode of incineration? (Dr. Regina Sagoe)

Answer: The vegetation was slashed after which burning was carried out after the crop residue was dry.

Question: Did you measure carbon emission estimates in the tillage methods used?

Answer: No carbon emission estimation was done. That can be considered in future studies.

Question: Can you elaborate on the tillage method used?

Answer: In the no tillage method, the land was slashed after which planting was done without burning. In the case of the tillage method, the land was ploughed either after burning or right after slashing.

Question: Are you aware that grasses absorb more greenhouse gases than trees?

Answer: Yes though grasses absorb more than trees, it takes much longer time to regenerate trees compared to grasses.

Question: From the graph there are two kinds of tillage and no tillage; dots and lines. What do they mean?

Answer: The dots represent the actual mean values but the lines represent the mean for all the genotypes

Question: From the presentation, no incineration with tillage was the most profitable. How does one get rid of the crop residue for instance if the previous crop was cassava?

Answer: Farmers are advised to choose the grassy fallows which do not require burning.

Question: What considerations were used in the cost estimation of the land preparation practice?

Answer: The cost of equipment, labour for slashing, etc.

Comments: Juma Yabeja

It is better to present the means in the table indicating significance difference where available than using graphs for easy understanding of the difference between the two methods used.

Comment: Frank Kumi

No tillage can also be done through the application of herbicides. Did you consider that in your study?

Answer: That was not considered. The focus of the study was on burning/incineration as against no burning/incineration

Gaps in cassava production environment: a review (Presented by *C.L.A. Asadu, S. Hauser and G.U. Nnaji*)

Cassava, (*Manihot esculenta Crantz)* is a crop plant of tropical lowlands between latitudes of 30^0 North and South. However, it is most wide spread near the equator between 15^0 North and South. Most researches in cassava have been on many aspects including responses to soil especially on organic and mineral fertilizer trials, pest and disease management systems. This review noted that researches in nutrient removed by cassava and nutrient concentrations of different parts of cassava are well documented. Furthermore responses of cassava to tillage methods in different parts of the world have been reported. Similarly, research activities on water and light needs of cassava are well known. The ever increasing population especially in Africa has led to increases in the demand for cassava for food, feed, fuel and raw materials.

Question: Why didn't you include a review on processing research activities? (Frank Ackah)

Answer: The focus of this review was on production environment. The processing aspect can be captured in other review

Question: Data on production trend was not current (2007 instead of 2012) why? (Frank Kumi)

Answer: The literature will be updated with current values.

Question: The data shown on the importation of fertilizer does not include Nigeria though it is the leading producer of cassava. (Frank Kumi)

Answer: The data has been captured in the full paper; the omission might be an oversight.

Question: There was no information of research on biotic stress in the review. (Dr. C.N. Ehisianya)

Answer: A lot of work has been done on biotic stress so it was not captured as a research gap that needs to be filled.

Question: Why didn't you include any review on the effect of organic manure on the nutritional composition of cassava as a research gap since most works carried out on fertilizer are based on morphological growth and yield? (Ezeocha Chinelo)

Answer: That will be considered in further review.

Comments:

- There are records of nutrient recommendations for crop combinations, contrary to your presentation that it is lacking. Check the NRCRI Umudike publications on farming systems. (Dr. Onunka)
- Recommendations on crop combinations are available in publication. Further research can be done to harness this especially in the south east agro-ecological zone of Nigeria. (Dr. Mark Tokula)
- It is important to network with other sources of information like institutions and expand the collaborations across disciplines to make the study holistic.

Mineral fertilization of *Pachyrhizus erosus* (L.) Urban cultivated on degraded Oxisol in Southern Benin. (Presented by *M. R. Aguégué, A. Adjanohoun, P. Y. Adegbola, K. A. Djinadou-Igué, O. D.Koudandé, P. Fandohan and G. A. Mensah*, Benin)

Many researches have been carried out on the evaluation of the productivity of *Pachyrhizus erosus* on soil whose chemical characteristics show good fertility rate. However, many of the southern Benin soils are degraded with drastically low fertility. The objective of the study was to evaluate the effect of mineral fertilizer on the productivity of *Pachyrhizus erosus* cultivated on degraded Oxisol in Southern Benin. Mineral fertilizer and density of sowing influenced the productivity of roots and seeds of *P. erosus* cultivated on ferralitic poor soils in South Benin. Future studies on the determination of the optimal amounts of nitrogenised mineral manures will be necessary. However the contribution of 30: 40::60; N: P: K associated with density of 30,250 plants/ha resulted in the highest number of roots no matter the *P. erosus* variety.

Question: Your work was limited to yield and growth of the crop. This should be reflected in the objective. Productivity in the objective should be deleted and replaced with growth and yield.

Answer: suggestions accepted. The necessary changes will be made.

Delivering the potential of potato in Mozambique: Challenges, opportunities and strategies. (Presented by *C. Lung'aho, M. Carolino and E. Schulte-Geldermann*)

Mozambique has not fully harnessed its potential to produce and possibly export potato and potato products. The country has vast amounts of fertile lands with favourable conditions for growing potatoes-good soils and climate, and water resources. Constraints to realizing the potential of the crop include poorly functioning potato value chains characterized by weak linkages with poor integration of value chain actors, poor seed systems, pests and diseases, limited access to favourable capital, low levels of commercialization, poor infrastructure and a weak private sector. Concerted efforts by both public and private sectors in strengthening the seed, ware and processing potato value chains could see the country becoming a major potato producer in the Southern African region in the next few years. Key issues that must be addressed for the potential to be unleashed include enhancing the capacity for potato research and development; availing appropriate financing mechanisms; stimulating enterprise development; enhancing skills development; and creation of effective mechanisms for the on-the-ground implementation of investments.

Question: What is the position of potato in Mozambique?

Answer: It occupies the 3rd position in terms of important food crops.

Question: What are some of the major diseases that affect the crop in Mozambique?

Answer: Bacterial blight, *Phytophthora alternaria* and a host of viruses.

Question: How do you control bacterial wilt in Mozambique?

Answer: Through the use of good quality seed and long rotation. Resistant varieties are not yet available. The national programme together with CIP has established some nuclear production sites from where good quality seeds can be disseminated.

Question: Why did you present the value chain development in 3 sections? I believe value chain development of commodities is presented as linked. So if you are to priorities, which of the various segments would you decide to work on? (Dr. Regina Sagoe)

Answer: Each of the sections is important so it becomes difficult to choose one over the other but one has to start from somewhere. Other activities will take care of the other segments such as post-harvest, etc.

Question: Will you advocate as intervention regarding access to credit facilities for farmers, large scale or for small scale farmers? (Dr. Aina)

Answer: Credit is available to whoever wants it, be it small or large scale.

Question: What are the major sources of credit facilities available to farmers?

Answer: Long term loan provision through the banks at low interest rates for both small and large scale farmers. On the interest rate, the amount is split so that farmers can access it as and when they need them.

Economic impact of weed control using herbicide on cassava crop (Presented by *A. Frangoie Ngoie, N.M. Mahungu and M. Ndonda*)

The presenter talked about the expensive nature of the common method of weed control especially in situations where labour was scarce. Chemical weed control was found to be a better alternative in cassava production. The objective of the study was to assess the economic impact glyphosate based weed control and assess whether reducing losses can increase efficiency and profitability.

Question: Did you consider the residual effect of the herbicide on the soil (Bello, A.A.)

Answer: The field was replanted with another crop the following season. The crops are yet to be harvested so any information on the residual effect will be known after the crops are harvested

Question: Are chemicals really suitable for cassava considering the risks involved? (Dr. Okonkwo)

Answer: Chemical weed control is becoming an alternative considering the large scale cultivation of cassava in recent years. So precautions have to be taken in their application

Question: On one of your tables, the CV was too high at one of the locations (Kisangai) Why? (Omolola Omolade)

Answer: There could be error with that location that is why no recommendation was made. The results will have to be confirmed first

Question: Since the study was conducted in the D .R. Congo (DRC), why don't you include DRC in the topic? (Okenmuo Frank Chibuzor)

Answer: That would be considered.

Question: Is glyphosate the herbicide which is supposed to be applied before planting? (Prof Sikirou)

Answer: It can also be applied after planting.

Effects of nitrogen sources on soil carbon sequestration in Umudike in Southeastern Nigeria (Presented by R. Njoku, R. Nwanyieze, Opara – Nadi, O. Eke- Okoro)

The presentation highlighted the increased awareness of greenhouse gas emissions and how the concerns about global warming have led to increased emphasis on sequestration of carbon in the soil. The objective of this study was to evaluate the effect of N sources on soil C storage in Southeastern Nigeria. The results from the study indicated that organic N sources enhanced C sequestration and, therefore will lead to a reduction in the contribution of the soil to CO_2 emission into the atmosphere.

Question: How do you establish that the carbon being measured is a result of soil carbon sequestration and not the base material in the formation of organic manure? (Dr. Regina Sagoe)

Answer: Urea which was used is inorganic and for that matter did not contain carbon so it is the plants that captured CO_2, converted into carbon and incorporated into the soil when the plant debris decompose.

Question: The control carbon sequestration from the table was 40% while the organic materials gave a higher value, what is the implication of the higher values obtained for the organic materials compared with the inorganic fertilizer? (Awa Olufemi)

Answer: This indicates that organic materials are safer and better than the inorganic materials used.

Question: Were the organic amendments used, applied at the same rate? (Dr Nnaji)

Answer: No, the rates were calculated based on their N content.

Best time of supplemental mulch application for turmeric production in a Rainforest Agro-Ecology of Nigeria. (Presented by Olojede, A.O., Nwokocha, C.C., Akinpelu, A.O., Obasi, C.P. and Ikeorgu F.)

The presentation was on the importance of Turmeric (*Curcuma longa* (Linn) and its worldwide production. The crop is valued for the yellow colour Curcumin content in the rhizome which accounts for about 6%. It is an important principal component of curry powder and an important colouring agent for food and dye. The objective of this study was to investigate the necessity and timing of supplemental mulch application in turmeric (Curcuma longa Linn) production under Umudike conditions. It was concluded that supplemental mulch application was necessary for Turmeric production and should be carried out at 2 MAP after initial mulch application for optimum rhizome yield.

Question: Mulch application at 2MAP gave a better yield than the other treatments in 2011 and 4MAP in 2012. I think you should have a 3rd year to be able to reach a valid conclusion.

Answer: The combined analysis of the two years to obtain a 3rd value revealed that the 2MAP was still the best treatment compared with the rest.

Question: What is the usual practice in India where Tumeric is widely cultivated regarding mulch application on Tumeric

Answer: Mulching in India is done at planting and remains intact till harvest.

Question: a) What is the purpose of the mulch?

b) What was the nature/ingredients of the mulch?

Answer: a) The mulch promotes sprouting of the planting materials, protects the soil from erosion, high temperature, weed suppression and decompose to add organic matter to the soil.

b) The mulch was mainly made up of organic materials.

Effect of fertilizer type and rate on growth morphology and yield of 4 yellow fleshed cassava genotypes at three locations in Nigeria (Presented by O.O. Aina, E. Y. Parkes, P. Iluebbey, T. Ayankanmi, N. Adetoro, A. Agbona, M.Yomeni, P. A. Kulakow)

Yield productivity in most farmers' field was often very low resulting from inadequate inputs and low soil fertility. However, research has shown that yield could be significantly increased through appropriate soil amendments that ensure sufficient soil nutrient for plant uptake.

In order to ensure the realization of the full potential of the crop, both the genetic component and the environmental component should be sufficiently adequate to ensure that yield was enhanced. The main objective of this study was to determine the response of cassava genotypes to different fertilizer types at different application rates and also identify the pattern of response. The results showed that the yellow root cassava significantly responded to inorganic fertilizer application with highest response (18.94t/ha) obtained from the application of NPK 15-15-15 at application rate of 600 kg/ha (60g/plant**)**

Question: The elemental compositions of the fertilizer used were not the same hence it is not possible to conclude that a particular treatment was better than the other. Do you agree?

Answer: Farmers normally go for quantity of fertilizer applied so the idea was to determine which quantity to apply in order to mimic what the farmers do especially when price differences among the different fertilizers are small. Besides, the common fertilizers available were considered in the determining of the rate.

Question: What were the factors of emphasis?

Answer: Fertilizer and varieties

Question: You reported that fertilizer had effect on emergence, when was the fertilizer applied?

Answer: Fertilizer was applied at two months after planting and establishment was taken at three months after planting.

Question: The organic matter content of your soil was too high, was the land a new forest?

Answer: The high organic matter values were the results obtained from the experiment so they were deemed to be the real situation on the ground.

Question: What accounted for different responses of the yellow fleshed cassava and the white fleshed ones?

Answer: It could be due to the difference in their nutrient uptake. Dry matter content is lower in the yellow fleshed cassava than the white genotypes.

Question: The values of the P content of the soils are indications that the soils were fertile. There was no need to apply the P fertilizer.

Answer: Agreed.

Yield and P use efficiency of two cassava genotypes under different P levels in a derived savanna of South West Nigeria (Presented by V.O. Aduramigba-Modupe, A.O. Aduramigba-Modupe,S.O. Olanipekun)

Cassava serves as a food security and income generating crop for >500 million people in the developing world. However, a big gap exists between its actual and achievable yields. In Nigeria, actual yields on farmers' field is 12.0 t/ha; potential yield is >45.0 t/ha. One of the major causes was low soil fertility, of which P plays a crucial role. The main objective of the study was to develop a P fertilizer management procedure for cassava using the fractional recovery P model of investigating optimum P rate for adequate supply and to improve fertilizer P use efficiency in cassava production. Phosphorus application significantly influenced cassava yields. This increased yield levels during the two cropping years can be attributed to availability of appreciable amount of P from organic P mineralization. The amount of P made available to cassava during the growing season through organic P mineralization need to be considered in cassava breeding program as an important factor in its production

Question: Did you estimate the original P level in the soil?

Answer: Yes it was estimated and found to be below the critical value.

Question: Do cassava plants undergo any luxurious consumption of P?

Answer: Cassava does not undergo luxurious consumption but uses the initial P for extensive root development.

Question: What informed your choice of the two varieties; TMS 01/1412 and TMS 01/1368?

Answer: They are elite genotypes with positive attributes. TMS 01/1412 is already released.

Question: Why didn't you do split application of the P?

Answer: P is not mobile in the soil so the idea of applying all at once is to afford the plants the opportunity to make the best use of the P for initial root development and since they are not mobile in the soil, they will be available to the plants anytime they need them.

Soil physico-chemical properties and rainfall relationship with cassava growth and yield in Nsukka southeastern Nigeria. (Presented by G. U. Nnaji and C. C. Obiazi)

Identification of soil nutrients which has significant influence on cassava yield in a given area will determine the type and quantity of fertilizer to be applied for crop improvement and soil conservation. The objectives of the study were to develop a relationship between some soil nutrient elements in an Ultisol used for cassava cultivation in Nsukka area and cassava root tuber yield and growth. The study revealed that, P, Ca, and Mg fertilizers could be recommended to cassava farmers in Nsukka area. Also, field trials of these fertilizers should be carried out in the area to determine the specific quantities to be applied.

Question: a) Why didn't you use any of the newly released varieties instead of 30572?

b) Can you try new genotypes like TMS 0581, 0505 or 0510:

Answer: a) As at the time of conducting this study, genotype 30572 was the elite genotype around hence its incorporation.

b) The new varieties would be considered.

Question: a) Can you explain the differences between macro porosity and total porosity?

b) Why do you have negative correlation between yield ad macro porosity but positive correlation between yield and total porosity?

Question: Since you did not show any relationship with rainfall, can you review your title to reflect only growth and yield?

Answer: The title would be reviewed.

Assessment of performance and farmers' preference varieties through participatory variety selection calls for doubling breeding effort in Zambia (Presented by *Ntawuruhunga P., Chiona M., Manda N., Korie S. and Njobvu J*.)

The cassava Production project in Zambia is using the participatory variety selection approach to understand why adoptions are low and identify best preferred improved varieties for promotion. Five improved varieties were evaluated under farmers' field conditions in 6 districts of Luapula, Both principal component analysis and correlation analysis confirmed that preferred varieties were mealy with good taste. Nalumino was the only improved variety averagely preferred by farmers. The present results are hence challenging breeders to double efforts in identifying and selecting high yielding pests and disease resistant varieties but most importantly acceptable to farmers in order to enhance adoption and boost production in the country.

Questions: What are some of the efforts made in the controlling of termite problems?

Answer: As at now we don't have any solution. But various types of chemicals have been tried but without much success.

Question: Farmers indicate preference of their own varieties; can these materials be cleaned and disseminated?

Answer: Yes the local varieties can be crossed and given to farmers for them to evaluate and select based on their preferences

Question: How can you explain why all the neighbours of Zambia are prone to CBSD?

Answer: As at now there has not been any reported case of CBSD in Zambia but there are indications that the country may face crises in future. Zambia has high populations of white flies which transmit the virus.

Question: What are some of the community challenges in the controlling of animals to advance initiatives on cassava development at the community level?

Answer: In the control of livestock, protection is key. Traditional leaders have also been involved to set up by-laws and possible fines that would mandate community members to confine their animals during the growing season. Most farmers indicated their preference for the cassava but were concerned about destruction by animals.

Questions: Why did you not involve more scientists from different disciplines during the evaluation/survey?

Answer: Cost implications and time prevented the involvement of many disciplines at initial stages.

Questions: a) What is the heritability estimate for mealiness? Do you know the genes?

b) How easy is it to breed for taste? How is taste defined? Does breeding address the complex value of "taste" that has huge variation?

Answer: a) Heritability for mealiness has not been estimated.

b) Taste is location specific; it is dependent on the kinds of food prepared from the roots. In Nigeria whereas the roots are processed into gari and for that matter less emphasis is placed on the boiled fresh roots, Zambian farmers prefer varieties that can be boiled and eaten. Therefore the farmers are allowed to make their choice of any variety that suits their preference.

Questions: With reference to strategies in controlling termites in cassava, are there studies to assess damage done by these termites to reduce cassava yields? (Dr. Regina Sagoe)

Answer: As at now there are no on-going studies.

Comment: In future get to know at first hand farmers interests before starting the breeding programme instead of bringing them on board mid-way. Encourage collaboration with genebank, socioeconomists (who may have this information), germplasm health and so on.

Comparison of cassava yield variations from five-year continuous cultivation under sole and mixed cropping systems in an alfisol of Eastern Nigeria. (Presented by *Asadu, C.LA., A.G.O. Dixon and R. Okechukwu*)

Four cropping arrangements namely Sole Cassava (SC), Yam+ Cassava + Maize + Pigeon Pea (Y+C+M+P), C+M+P and C+P mixtures were grown continuously for four years in an ultisol brought into cultivation as a virgin forestland. The objective was to compare cassava yield variations as affected by residue management and zero external input considered as a low input technology beneficial to low income farmers. All the crop residues especially the above ground vegetation (leaves from yam, cassava and pigeon pea and the entire for maize except the cob) were incorporated into the soil as sources of nutrients. The study showed that year-to-year cassava root mean yield was highest in C+M+P or C+P plots though the differences were not significant. The overall trends in results portrayed an indication that soil incorporation of residue was sustainable especially with zero external input in the four cropping arrangements studied.

Question: The yield in mixed plot was higher than sole cassava. This is not supposed to be so. Why? (Dr. V.O. Aduramigba-Modupe)

Answer: When cassava is planted in a recently cleared forest, it grows vegetatively at the expense of root growth. In the case of the mixed plot, the different crops interacted with the cassava on the soil thereby reducing the amount of nutrients available to the cassava compared to the sole cassava which produced more shoot weight at the expense of roots.

Question: a) Why didn't you present the performance across years as a trend?

b) Explain why you presented an insignificant interaction between cropping system and year but you concluded by saying continuous cropping favours mixed cropping?

Answer: a) That would be considered.

b) In the case of mixed cropping, the crop residues were incorporated into the soil so they make a better organic matter addition to the soil than the sole cropping. This makes it beneficial in the long term nutrient management in the case of continuous cropping without external inputs.

Question: Why didn't you estimate the effect of the associated intercrops with regards to the intercrop competition? (Dr. Joseph Manu-Aduening)

Answer: That has been captured in the land equivalent ratio estimation.

Question: Why didn't you subject your data to combined analysis of variance over years? This would have assisted you in making valid recommendations. (Dr. A.O Olojede)

Answer: It would be considered.

Comment/contribution: Dr. Okogbenin

1. Showing a graph of the trend of performance would have been a better means of explaining the variation within the four years
2. Varietal response could have resulted in the concept of luxurious growth of cassava under sole cropping.

Productivity and field disease reaction of biofortified cassava genotypes in Nigeria (Presented by *A.A. Bello, Parkes, E., Aina, O.O., Maroya, N.G, Kolawole, R., Akoroda, M.O., Kulakow, P*)

The presenter highlighted on the production and utilization of cassava as well as the nutritional benefits of bio-fortified cassava. Vitamin and Minerals: Calcium (50 mg/100g) Magnesium (40mg/100g), Vitamin C (25mg/100g) thiamine and riboflavin (Ceballos *et al*., 2004). Yellow root cassava has superior concentrations of provitamin A carotenoid which can help combat Vitamin A deficiency. The objective of this study was to assess the productivity of some improved cassava genotypes for fresh root yield, total carotenoid content, dry matter content, dry yield, number of roots per plot, harvest index and their field reactions to cassava mosaic disease (CMD) and cassava bacteria blight (CBB). The result of this study suggests that it is possible to make progress in breeding and selection of yellow cassava with superior yield and resistant to economically important biotic stresses CMD and CBB. The study revealed highly significant influence of genotype and environment on CBB, CMD and yield related traits.

Question: Some varieties have been shown in earlier presentations with high dry matter and high TCC but your population has both low dry matter and TCC. Do you hope to make any gain?

Answer: There are different projects looking at the same objectives. The genotypes the others are screening are different from mine.

Question: Planting distance in the presentation was 1m x 0.8m. Why didn't you use the recommended spacing of 1mX1m?

Answer: The closer spacing ensured higher population so the extra plants compensated for the closer spacing which may result in lower yield per plant.

Comments: The closer spacing is normally used for erect non-branching genotypes to ensure optimum ground coverage whereas profuse branching genotypes are limited to the 1mX1m to prevent too much intraspecific completion. (Dr. Regina Sagoe)

Question: Why did you go as much as 1% alpha level in testing your variance ratio (Fcal) when the standard is 5% for typical field experiment? (Dr A.O. Olojede)

Answer: 1% alpha level is more reliable.

Evaluation of different animal manures as plant nutrient sources on the production of cocoyam (*Colocasia esculenta*) in inland valleys of Southeastern Nigeria. (Presented by *Nwite, John C., Okolo, C. Chukwuebuka, Igwe, Charles A., Ezeaku, Peter I., Chukwudi, P. Uchechukwu., Nwite, James N.., Okenmuo, Frances C., Agbo, Emmanuel A. and Umeugochukwu, Obiageli P.*)

The soils of Ebonyi State, South-eastern ecological zone of Nigeria are plagued with characteristics that impede optimal crop production. In order to arrest the declining productivity of the degraded soils in this zone, an appropriate soil management practices are needed. A study was conducted to investigate the influence of animal manures (poultry droppings, cattle dung and pig dung), including the control, as plant nutrient sources on the growth and yield of cocoyam. The results revealed that application of organic manure to the soil improved its fertility which resulted in high yield over the control. Poultry droppings were also recommended as an alternative plant nutrient source for the production of cocoyam in Ebonyi State south-eastern Nigeria.

Question: Was the effect of the cow-dung different from the poultry droppings?

Answer: There was no statistical difference between poultry droppings and cow dung.

Question: How did you ensure that the organic manure you applied remained in the same plot especially when the experiment was laid out in a valley? Did you analyse the nutrient content of the organic manure used in the experiment at the beginning of the experiment? (Dr. Regina Sagoe)

Answer: The SAWA system was used. The nutrients were not analysed prior to the experiment.

Question: a) What was the control in your trial?

b) Would you do another soil analysis after harvesting of the trial?

c) Would determine if there is any correlation among parameters collected with yield?

Answer: This is an ongoing experiment so post experimental soil analysis would be carried out. Correlation analysis would also be run among the parameters to see their effect on yield.

Question: Why did you stay at the 0-20 cm instead of going to the sub-soil?

Answer: As agronomists, the interest is in the top soil that is why we did not go to the sub soil.

Question: Can you clarify the source of the manure because the quality depends on what animals were fed on and the storage facilities of the manure? (Dr. Joseph Kamau)

Influence of soil moisture stress on vegetative growth and root yield of some selected cassava genotypes under greenhouse condition (Presented by *Adetoro, N. A., Oworu O.O., Parkes E., Aina O., Iluebbey P., Agbona A. Kulakow P.*)

Cassava can survive under severe soil moisture deficits, however, economic yields is adversely affected by drought. This study was carried out to determine how variation in shoot and root characteristics affect tuber yield and the influence of soil moisture stress on the vegetative growth and yield of cassava genotypes. The results revealed that genotypes IITA TMSIB 010040, 011086 and 920326 were identified as having good drought tolerant abilities. As cassava cultivation is expanding into non-traditional areas, such as the semi-arid regions of sub-Saharan Africa, a concerted effort in breeding cassava for drought tolerance is more than needed. Germplasm introduction from Latin America is providing unique sources of variability to further broaden the genetic base for drought tolerance in cassava.

Question: What informed your choice of the control of 70% moisture content?

Answer: It was a method proposed by someone else and in trying to imitate or induce the conditions in a screen house, these conditions were used.

Question: The induced conditions did not reflect real experimental separate treatments at 25 FC, 50 FC and 75 FC.

a) Could you run an interaction effect of the parameters?
b) Treatments were not separated to reflect the control treatment.

Answer: Yes it is part of the things that would be done or have been done previously. This is part of a PhD work and a lot of this work is being monitored under field conditions and being replicated under screen house conditions.

Question: The choice of the water levels should be varied to accommodate more growth points. Why didn't you vary the amount of water reducing intervals and even going beyond only three levels?

Variation of harvest index and dry matter content of yam bean (*Pachyrhizus spp*.) accessions in two major agro ecological zones of Uganda (Presented by *Agaba. R, Tukamuhabwa. P, Rubaihayo. P, Tumwegamire. S, Mwanga. R and Grüneberg. W.*)

The yam bean (Pachyrhizus spp.) is a legume root crop and a close relative to soy bean taxonomically. Yam bean is propagated by true seed, has high nitrogen-fixing capacity and high storage root yields however, the storage root dry matter content of yam beans is very low (SRDM less than 10%) which may limit adoption and utilization. This study was conducted to determine variance components for dry matter and harvest index (HI) among the yam bean accessions to identify high yielding genotypes as base population for hybridization. The results from the study indicated that better yields were obtained under high rainfall conditions. Dry environments however reduced above ground biomass and increased storage root dry matter. This means that when targeting high dry matter, semi-arid environment is more suitable

Question: Has any work been done on intercropping possibilities of the African yam with other crops?

Answer:

Question: Why did you arrive at the 100% HI in genotype 209025 since HI is calculated on economic yield/total biomass yield? (Dr A.O. Olojede)

Answer: The total biomass yield was equal to the economic yield since at the time of harvesting there was no top biomass.

Evaluation of some improved and local yam genotypes for yield and yield components in northern Ghana. (Presented by *J. Adjebeng-Danquah, S.K. Asante, K. Acheremu, A. Nimo-Wiredu, F. Kusi*)

Yam dioscorea spp are among the oldest recorded food crops believed to have originated in tropical areas. Though six species are cultivated as staple food, D. *rotundata* is the most widely cultivated within the yam zones of West Africa. Production level is still too low to meet the ever increasing demand for local consumption and export due to the cultivation of local low yielding varieties by farmers. Improved varieties are few and non-available to farmers. The objective of this study was to evaluate and select high yielding disease-resistant improved yam genotypes (from IITA), that meet farmers preference. The results from this trial identified some promising genotypes which can be taken through multilocational trials to assess their stability and possible release to farmers to boost yam production in northern Ghana and alleviate poverty.

Question: Did you determine the initial property of the soil used for this study? Did you amend the soil with any fertilizer in order to meet the nutrient requirement of yam? Did you standardize the planting materials (ensuring uniform planting material)?

Answer: These were not done. The focus was on the differential response of the different genotypes to the natural conditions

Question: Why assess the level of treatment significance on the basis of treatment mean square as against the treatment variance ratio (Fcal)? Any explanation for the reduction in dry matter content at the second harvest in genotypes 95/18544 and 95/19177? Was data on diseases and pests scores transformed? That ought to be used.

Answer: 1) That is exactly what was used

2) Probably due to physiological differences or differences imposed by sampling

3) Data was transformed but the raw data was presented so the transformed data will be used in the discussion

Question: a) How did you assess the pests and diseases?

b) What form of transformation did you do for the count?

Answer: a) At each harvest time, the tubers were carefully sorted and grouped into the identified pests and diseases. The proportion of tubers infested with a particular pests or disease was estimated as a percentage of the total number of tubers

b) The data was transformed using arsine transformation.

Question: Can you clarify how you did the sampling? Did you harvest at 6 months, and then harvested again at 8 months? (Dr Elizabeth Acheampong)

Answer: Part of the experimental materials was harvested at 6 months whilst the other part was harvested at 8 months. The number of plants required for yield assessment was taken into account during the establishment of the experiment.

Question: Did you compare the yields obtained with those of the potential yields of those genotypes in order to know the causes of the differences between those genotypes and the low yields of the local genotypes? This will help you to relate the yield to the climatic contributions to the performance of the genotypes and even the soil factors. (Dr Godwin Nnaji)

Answer: No such comparison was made. The focus of the experiment was relative genotypic performance of the different yam genotypes. The interest was on which genotype gives the best yield performance in that particular agroecology.

Question: The difference in dry matter content of the same variety at different harvesting period is questionable and needs explanation. (Dr N.A. Onunka)

Response: The lower dry matter value obtained at the second harvest could be due to the physiological changes that might have taken place in the tubers.

Question: In your effort for multilocational trials, how do you cope with the issue of palatability? Yield and consumer acceptability due to palatability may clash (Dr. Elizabeth Acheampong)

Answer: In the evaluation process, farmers are made to assess the plants when they are on the field and also during harvest. Cooking quality tests are conducted after which farmers are asked to make a choice of the varieties that meet their expectations. The assessment of the improved genotypes was done alongside the farmer-preferred local varieties.

5.0 CHALLENGES AND CRITICAL GAPS IN ROOT AND TUBER CROPS VALUE CHAIN IN AFRICA.

There are several challenges and critical gaps in the Root and tuber Crops value chain in Africa. These include production, capacity building, postharvest handling and advocacy. Major production challenges include;

- Diseases (Taro leaf blight and Cassava Mosaic Disease)
- Unavailability and sustainability of clean and healthy planting materials
- Declining soil fertility
- Post physiological deterioration of harvested root and tubers
- Low technology adoption rate.

The availability of new technologies on root and tuber crops in Africa should be made known through sensitization, capacity building and advocacy activities.

Other challenges and critical gaps in the root and tuber value chain in Africa are listed below:

- Robust and quality seed systems (lack of efficient delivery mechanisms for quality seed)
- Breeding to increase nutrients in root and tuber crops
- Sporadic drought in the sub-region
- Root and tuber genetic resources conservation and management
- Limited packaging of root and tuber crops
- Low investment in root and tuber research and development
- Inadequate research support from African Governments on roots and tuber crops

6.0 RESEARCH OPPORTUNITIES ON ROOT AND TUBER CROPS IN AFRICA.

There are several research opportunities for root and tuber crops. This demands research focused on market oriented strategies for the root and tuber crops. The following listed areas have been identified for research and development:

1. Expanding the inadequate seed systems for root and tuber crops
2. New production technologies for root and tuber crops
3. Postharvest management for root and tuber crops
4. Quality control in handling and processing of fresh material and processed products
5. Extending the short shelf-life of produce and products of root and tuber crops.
6. Alternative uses of waste/by-products as animal feed (poultry and livestock) and mushroom cultivation
7. Diversification of value added products of root and tuber crops
8. Continuous soil management for maximum productivity
9. Marketing linkages of produce and products for profitability.

7.0 CLOSING CEREMONY

The session started at 7:30 pm. Dr. Nzola Mahungu, the President of ISTRC-AB, apologized for the late start and explained that the programme had to wait for the participants who had gone on a field trip earlier in the day. Afterwards he led members through the agenda for the closing ceremony.

Reports by Officers of the Society

Some Executive members of the Society namely the Treasurer, Editor, Secretary General, West African representative and East African representative presented reports on their activities since their last meeting.

Venue for the next meeting

Members were reminded that the venue for their meetings should be rotational among West, East, Southern and Central Africa. It was therefore the turn of East Africa to host their next meeting. Members finally agreed on Tanzania.

Awards for Best presenters

The Chairman on behalf of the Society presented cash awards for the following:

- Best Young oral presenter - $100.00
- 2nd Best Young presenter - $50.00
- Best Young poster presenter - $50.00.

The Chairman explained that the awards were given to young scientists to inspire/motivate them to work harder and write good scientific papers.

IITA Re-Union

A participant announced that IITA was planning to meet research scientists who had done research at IITA or had been employed by IITA before. The idea was to bring them together to discuss how their carriers have progressed since they left IITA. The alumni were asked to visit a website; www.iita.org for further information and to register online at a fee of $100.00.

Report on Symposium

This was presented by Prof. K. Afreh-Nuamah, Chief Rapporteur for the symposium. He presented statistics on the participants (their home countries and the gender proportions) and the abstracts presented (according to disciplines). He spoke on the major themes on which

there were presentations during the plenary sessions such as Biofortification of cassava for improved nutrition, activities of CGIAR and Seed Systems. He noted that there were a lot of scientific presentations during the plenary sessions instead of focusing on policy issues. The sub-themes for the Symposium were also not addressed during the presentations. A participant suggested that there should have been statistics on the presentations according to crops or commodities. Another suggested similar statistics on poster presentations.

Election of New Executive Members

Members voted to elect Prof. Latif Sanni as new President and Dr. Joe Manu Aduening as the new West African Representative of the ISTRC-AB. There were other executive positions to be occupied by new members but there was one nominee for each of the positions so members agreed to accept the nominees as duly elected. These other positions were: Vice President I, Vice President II, Secretary General, Assistant Secretary General, Editor-in-Chief, Deputy Editor, Treasurer, Fund Raiser, West Africa Representative, East Africa Representative, South Africa Representative and Central Africa Representative.

Closing

The Symposium closed at 8:30 pm after a vote of thanks by Dr. Grace Bolfrey-Arku.

8.0 CONCLUSION

The future of root and tubers in Africa is bright. Several new technologies have been developed and presented at the symposium. New approach to quality seed systems, production technologies, handling processing and shelf-life are currently being developed to help research and development in the root and tuber crops.

However, several new strategies are required to address the numerous researchable areas in order to create a more dynamic and competitive export oriented market for produce and products of root and tuber crops as income generation venture for all stakeholders.

9.0 CONFERENCE RECOMMENDATIONS

- There is the need to develop knowledge sharing portals for ISTRC mandated crops, such as cassava, cocoyams, taro in Africa as done for sweet potato
- For increased rate of adoption of root and tuber technologies, the following concerns must be addressed:
    - Complete exposure of farmers to the rapid multiplication techniques (such as yam minisett technology, vine technology, taro multiplication)
    - Facilitate access to credit to enhance technology adoption
- Enhance collaboration among scientists in Africa and International Centres for exchange materials, relevant information and training
- Work on root and tuber should be extended to cover Irish and f*rafra* potatoes
- Need to move from subsistence to commercial production in R&T as in Thailand and India
- Encourage strong on-farm processing of cassava to enhance production
- Diversify cassava and cocoyam use (e.g. for feeding of poultry, starch, plywood and other industries) to increase demand for the crops
- Dry season livestock and micro-animals feeding should be linked directly to utilization of massive expanded production wastes from the root and tuber research programmes
- Strong collaboration should be established between the NARs of sister Africa countries
- Increase financial and technical support for research on Colocasia and Taro sp.
- Vitamin A content in cassava must be improved through bio-fortification
- Promotion of safety precautions in the use of equipment and effluent handling (with regards to mechanization and commercial production)
- The green revolution and genetic modification may intensify genetic erosion. It is important to take the conservation of plant genetic resources seriously so that we do not lose essential germplasm
- Improve support for extension system through the following:
    - Intensification of mass communication systems and electronic media for extension delivery (radio programmes, information vans, posters, etc.)

Appendix 1: Selected photographs of symposium

Director General – CSIR

High Table

President of ISTRC -AB

Conference Participants

IITA Director General

Group Photograph

Appendix 2: Registration List of Participants

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