West Africa Agricultural Productivity Programme (WAAPP-GHANA)

NATIONAL CENTRE OF SPECIALISATION ON ROOT AND TUBER CROPS

Regional Conference

Book of Abstracts/ Conference Programme

Theme:

RESEARCH IN ROOT AND TUBER CROPS VALUE CHAIN DEVELOPMENT: THE HOPE FOR FOOD SECURITY IN THE ECOWAS SUB REGION

1st to 7th May, 2016
CSIR-Crops Research Institute,
Fumesua-Kumasi, Ghana

WAAPP-GHANA NATIONAL CENTRE OF SPECIALISATION ON ROOT AND TUBER CROPS

FOREWORD

The West Africa Agricultural Productivity Program (WAAPP) initiated by the Economic Community of West African States (ECOWAS) member countries is part of the implementation of the agricultural sector of the Millennium Development Goals (MDGs) and aims to support regional cooperation in agriculture in West Africa in accordance with the action plans for managers in the agricultural policy of ECOWAS and NEPAD. It receives financial support from the World Bank and sub-regional coordination of the program is provided by the West and Central African Council for Agricultural Research and Development in Africa (WECARD/CORAF). The program which started as WAAPP-1A in 2008 and continued as WAAPP-2A in 2013 aims at contributing to sustainable increases in agricultural productivity in national and regional priority sectors that are more likely to increase the agricultural growth rate for the participating countries and provide support to regional integration as an instrument to promoting shared growth. These supports have a developmental goal to intensify generation, dissemination and adoption of improved technologies in the agricultural priority commodities of the participating countries. Reaching this objective implies the strengthening of regional cooperation in the generation of technologies; scaling up dissemination and developing collaborative mechanisms. To achieve this, the National Centre of Specialization (NCoS) in Ghana, CSIR-Crops Research Institute is organizing this regional conference to create a platform to strengthen National and Regional multidisciplinary networks and for identification, planning and implementation of common research problems and solutions on root and tuber value chain development in the different countries in the WAAPP. The main objective of this workshop is to share knowledge on root and tuber crops value chain research and development activities in the sub region, and establish effective networking groups in the development of concept notes that addresses regional common issues. Specifically this workshop or conference will create a platform for identification of common regional agricultural research problems and develop conceptual notes for further development.

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Table of Contents

FOREWORD 1
Table of Contents 2
TENTATIVE PROGRAM 4
ABSTRACTS OF KEYNOTE PRESENTATIONS 18
ABSTRACTS OF TECHNICAL SESSIONS 24
CASSAVA TECHNICAL SESSION 24
YAM TECHNICAL SESSION 48
COCOYAM TECHNICAL SESSION 66
SWEETPOTATO TECHNICAL SESSION 82

TENTATIVE PROGRAM

Day 1: May 1, 2016: Arrival of participants

Day 2: May 2, 2016- OPENING SESSION
MC: Drs. Grace Bolfrey-Arku and J. Nketiah-Berchie
Rapporteurs: Dr Kingsley Osei, Mr Isaac Baning, Mr Kwadwo Adofo, , Mr. Eric Danquah, Mr Albert Aubyn, Ms. Alimatu Sadia Osman, Mr Atta Aidoo Snr., Mr Jonas Osei Adu

DAY 2 :May 2 - OPENING SESSION		
TIME	**ACTIVITY**	
8.00 – 9.00am	Arrival of Participants/Registration	WORKSHOP SECRETARIAT
9.00 – 9.05am	Opening Prayer	Dr Adelaide Agyeman
9.05 – 9.15am	Introduction of dignitaries	MC
9.15 – 9.20am	Introduction of Chairman	Dr. Marian Quain
9.20 –9.30am	Chairman's Opening Statement	Dr. Victor Agyeman, Director General, CSIR
9.30 – 9.40am	Welcome Address	Dr. Stella Ama Ennin, Director, CSIR-CRI
9.40 - 9.50am	Statement by World Bank	WB representative
9.50 – 10.00am	Overview of WAAPP in the West Africa sub-region	WECARD/CORAF representative
10.00 – 10.15am	Highlights of WAAPP, Ghana	Ms. Azara Ali Mamshie, National Project Coordinator,
10.15 – 10.30am	Overview of WAAPP,CSIR Ghana	Dr.(Mrs) RoseEmma Mamaa Enstuah Mensah, DDG-CSIR
10.30 – 10.45am	Keynote Address	Hon. Dr. Alhassan Yakubu (Dep. Minister of Agriculture (Crops)
10.45 – 10.50am	Chairman's Remarks	Dr. Victor Agyeman, Director General, CSIR
10.50 – 10.55 am	Vote of Thanks	Dr. Ruth Prempeh
10.55 – 11.30am	Exhibition Group Picture / Snack break	

DAY 2 : TECHNICAL SESSION 1 **Key note papers on the sub theme "Towards a sustainable productivity: root and tuber crops value chain research and development** **Chair:** Prof. G. Dowuona, COSMAC CHAIR		
TIME	ACTIVITY	
11.30 - 11.50pm	Towards a Regional Centre of Excellence: Achievements of WAAPP-NCoS, Ghana	Dr. Regina Sagoe, NCoS Coordinator, CSIR-CRI
11.50 – 12.00pm	Discussions	
12.00 – 12.20pm	1st Keynote paper –*Marketing and commercialization: involving the private sector in R&T value chain development*	Mr Anthony Sikpa, President Ghana Yam Export Association.
12.20 – 12.35pm	Discussions	
12.35 – 12.55pm	2nd Keynote paper – *Developing R&T for value addition, the way forward*	Prof. Ibok Oduro, KNUST-Kumasi
12.55 – 1.10pm	Discussions	
1.10 – 1.15pm	Chairman's closing remarks	COSMAC Chair
1.15 - 2.00pm	Lunch	

DAY 2 : TECHNICAL SESSION 2 **Chair: Prof. Paa Nii Johnson, CSIR**		
TIME	ACTIVITY	
2.00 – 2.20pm	3rd Keynote paper –*Towards Integrated Agricultural Research and Extension Delivery for R&T development*	Dr Stella Ama Ennin, Director, CSIR-CRI, Kumasi
2.20 – 2.35pm	Discussions	
2.35 – 2.55pm	4th Keynote paper –T*echnology and innovations in R&T value chain development.*	Prof. Richard Akromah, Provost, College of Agric. and Natural Resources, KNUST
2.55 – 3.10pm	Discussions	
3.10 – 3.30pm	Chairman's Closing Remarks	
3.30pm	Closing Prayer	

Day 3- May 3, 2016
Cassava Technical Session (CTS)
MC:

TIME	ACTIVITY		CHAIR/RAPPORTEUR
8.00 – 8.20am	Registration		
8.20 – 8.30am	Summary of Day 2 Proceedings	Rapporteur General	Chair: Prof. Isaac K. Asante, UG-Legon
8.30 –9.00am 9.00 – 9.15am	Keynote Paper Cassava value chain research and development in the sub region Discussions	Dr Alfred Dixon, IITA, Ibadan-Nigeria	
9.15 – 10.05am	CTS-1 Technical presentations (5 oral presentations)		
10.05-10.15am	Discussions		
10.15 – 10.45am	Coffee/Tea break		
10.45 -11.35am	CTS-2 Technical presentations (5 oral presentations)		
11.35 -11.45am	Discussions		
11.45 – 12.45pm	CTS-3 Technical presentations (5oral Presentation)		
12.45 - 1.00pm	Discussions		
1.00 – 1.30pm	Poster sessions/Exhibition		
1.30 – 2.30pm	Lunch break		
2.30 – 4.30pm	GROUP Session – Regional concept note on Cassava value chain R&D		Moderator: Prof JP Tetteh, UCC, cape Coast
4.30pm – 5pm	Group presentation and Closing		

Day 4 - May 4, 2016
Yam Technical Session - YTS (Day 4)
MC:

TIME	ACTIVITY		CHAIR/RAPPORTEUR
8.00 – 8.20am	Registration		
8.20 – 8.30am	Summary of Day 3 Proceedings	Rapporteur General	
8.30 –9.00am	Keynote Paper Yam value chain research and development in the sub region	Dr Maroya Norbert, IITA, Ibadan)	Chair: Dr Charles Tortoe Rapporteur:
9.00 – 9.15am	Discussions		
9.15-10.00am	YTS-1 (5 oral presentations)		
10.00 – 10.15am	Discussions		
10.15 - 10.45am	Coffee break		
10.45 -11.30am	YTS -2 (5 oral presentations)		
11.30 -11.45am	Discussions		
11.45 – 12.30pm	YTS-3(5 oral presentations)		
12.30 - 12.45pm	Discussions		
12.45 – 1.30pm	Poster sessions/Exhibition		
1.30 – 2.30pm	Lunch break		
2.30 – 4.30pm	GROUP Session – Regional concept note on yam value chain R & D		Moderator: Dr J N L Lamptey
4.30pm – 5pm	Group presentation and Closing		

Day 5- May 5, 2016
Cocoyam Technical Session - CYTS (Day 5)

TIME	ACTIVITY		CHAIR/RAPPORTEUR
8.00 – 8.20am	Registration		
8.20 – 8.30am	Summary of Day 4 Proceedings	Rapporteur General	
8.30 –9.00am	Keynote Paper on Cocoyam value chain research and development in the sub region	Dr Joseph Onyeka, NRTCRI, Umudike-Nigeria	Chair: Dr Emmanuel Otoo Rapporteur:
9.00 – 9.15am	Discussions		
9.15 – 10.00am	CYTS-1 (5 oral presentations)		
10.00 – 10.15am	Discussions		
10.15 -10.45am	Coffee/tea break		
10.45 -11.30am	CYTS-2(5 oral presentations)		
11.30 -11.45am	Discussions		
11.45 – 12.30pm	CYTS-3(5 oral presentations)		
12.45 - 1.00pm	Discussions		
1.00 – 1.30pm	Poster sessions/Exhibition		
1.30 – 2.30pm	Lunch break		
2.30 – 4.30pm	GROUP Session - Regional concept note on Cocoyam value chain R&D		Moderator: Dr. Lawrence Aboagye
4.30 – 5.00pm	Group presentation and Closing		

Day 6- May 6, 2016
Sweetpotato Technical Session – STS
MC:

TIME	ACTIVITY		CHAIR/RAPPORTEUR
8.00 – 8.20am	Registration		
8.20 – 8.30am	Summary of Day 5 Proceedings	Rapporteur General	8.20 – 8.30am
8.30 –9.00am	Keynote Paper on Sweetpotato value chain research and development in the sub region	Prof. Harrison Dapaah, UCEW-Mampong	Chair: Dr S. Nutsugah, SARI Rapporteur:
9.00 – 9.15am	Discussions		
9.15 – 10.00am	STS-1 Technical session(5 oral presentation)		
10.00 – 10.20am	Discussions		
10.20 -10.45am	Coffee/tea break		
10.45 -11.30am	STS-2 Technical session(5 oral presentation)		
11.25 -11.45am	Discussions		
11.45 – 12.30pm	STS-3 Technical session (5 oral presentations)		
12.25 - 12.45pm	Discussions		
12.45 – 1.30pm	Poster sessions/Exhibition		
1.30 – 2.30pm	Lunch break		
2.30 – 4.30pm	GROUP Session - Regional concept note on Sweetpotato value chain R & D		Moderator: Dr Roger Kanton
4.30 – 5.00pm	Group presentation and Closing		

Day 6 - MAY 6, 2016 CLOSING SESSION

5.00 – 5.15pm	Summary of workshop	Rapporteur General	Chair Dr Stella A. Ennin
5.15 – 5.20pm	Closing Statement (WAAPP)	Madam Azara Ali Mamshie	
5.20 – 5.25pm	Closing Remarks	Director-CRI	
5.25 – 5.30pm	Vote of thanks	Dr Patricia P. Acheampong	
5.30 – 5.35pm	Closing Prayer End of workshop	Mrs Joyce Haleegoah	
7.00pm	DINNER		

DETAILED PROGRAMME FOR THE SCIENTIFIC SESSIONS

Day 3- May 3, 2016

Cassava Technical Session (CTS)

Time	Oral Presentations	
	Title of Paper	**Lead Author**
9.15 – 9.25am	Croissance végétative et suivi des maladies et ravageurs des hybrides de manioc (Manihot esculenta Crantz) issus de semis de graines "Vegetative growth and monitoring of diseases and pests of cassava (Manihot esculenta Crantz) hybrids)"	Boni N'ZUE
9.25 – 9.35am	Improving Cassava Productivity Through Sustainable Nutrient Management	ABDUL CONTEH
9.35 – 9.45am	Caractérisation agro-morphologique des accessions de manioc (*Manihot esculenta Crantz*) cultivées en Côte d'Ivoire "Agro-morphological characterization of cassava accessions (*Manihot esculenta Crantz*) cultivated in Côte d'Ivoire"	Konan Engueran DJAHA
9:45 – 9: 55am	Usage of constructed well in Gari Processing Unit in Yaba	Michael Adedotun
9.55 – 10.05am	Growth, Development and Yield of cassava progenies as affected by Nutrient Status of Mother Plants	Joseph Nketia Berchie
10.45 –10.55am	Enzymatic Enzymatic polymorphism of genetic diversity in cassava (*Manihot esculenta Crantz*) accessions in Côte d'Ivoire	Edmond Kouablan KOFFI
10.55 – 11.05am	Evaluation of released cassava varieties for delayed Postharvest Physiological Deterioration (PPD)	Ruth Naa Ashiokai Prempeh
11.05–11.15am	Morphophysiological parameters for invitro selection of cassava genotype tolerant to salinity	Bassirou DIALLO
11.15–11.25am	Additive main effect and multiplication interaction analysis and estimation of genetic parameters of growth and yield parameters in cassava in forest and savanna ecologies in Ghana	J. Adjebeng-Danquah
11.25-11.35am	In Vitro Conservation of *Manihot esculenta spp* (Cassava) Genetic Resources in Ghana	Asomani Antwi Naomi
11.45 – 11.55am	A preliminary investigation into Cassava root rot disease in the Brong Ahafo region of Ghana	Susana Akrofi
11.55–12.05pm	Performance of an improved manual cassava harvesting tool as influenced by planting position and cassava variety	Shadrack Amponsah
12.05–12.15pm	Cassava as an industrial crop: the Dadtco experience in Ghana	Kodwo Osei-Sarfo

DETAILED PROGRAMME FOR THE SCIENTIFIC SESSIONS

Day 3- May 3, 2016

Cassava Technical Session (CTS)

1.00 – 1.30pm	**Poster Presentations**	
	Title of Paper	**Lead Author**
	The effect of cassava plant architecture on crop productivity in various cassava-maize cropping systems in Sierra Leone	Keiwoma Yila
	Growth Performance of Grasscutters (*Thryonomys swinderianus*) in Captivity Fed on Pelleted Forage and Cassava Tubers with the Peel in Ghana	Seidu J. M
	Improving the multiplication rate of tissue culture acclimatized cassava planting materials under screen house conditions	David Appiah-Kubi
	Induction Of Embryogenic Structures And Plantlet Regeneration In Local Cassava (*Manihot Esculenta Crantz*) Varieties	Mongomaké KONE
	Utilisation des méthodes de la culture in vitro pour conserver, multiplier et distribuer des boutures assainies, indemne du Virus de la Mosaïque du Manioc en Afrique de l'Ouest et du Centre "Using in- vitro methods to preserve, multiply and distribute clean cuttings, free from the Cassava MosaicVirus in West and Central Africa"	Djinadou A. K Alice
	Survey on the occurrence and distribution of major cassava arthropod pests in Sierra Leone	Augustine Mansaray

DETAILED PROGRAMME FOR THE SCIENTIFIC SESSIONS

Day 4 - May 4, 2016
Yam Technical Session - YTS (Day 4)

	Oral Presentations	
Time	**Title of Paper**	**Lead Author**
9.15–9.30am	Producing Yam for Export : The Influence of Seed Sett Size and Planting Density on Tuber Size	Eric Owusu - Danquah
9.30 – 9.45am	Seed yam production in Ghana	Samuel Owusu
9.45 – 10.00am	Improved agronomic practices for sustainable yam production: The on - farm experience	Eric Owusu - Danquah
10.45 – 11.00am	Increasing Farmers'Access to Conserved Yam Genetic Resources in Ghana	Lawrence M. Aboagye
11.00 – 11.15am	Seed yam generation: a low cost but efficient techniques	Otoo Emmanuel
11.15 – 11.30am	Management of root-knot nematodes with *Trichoderma virides*	ZipporaAppiah-Kubi
11.45 – 12.00pm	Influence of fertilizer application on postharvest storage of white yam tubers	Atta Aidoo
12.00 – 12.15pm	Value addition characteristics of water yam (*Dioscorea alata*) varieties marketed in the Ashanti Region of Ghana: Prospects for expansion in utilization and trade	Evelyn Adu-Kwarteng
12.15 – 12.30pm	Gender Diversity in Soil Fertility Management for Yam Production in Ghana; The Case of Ejura Sekyeredumase District	Mr. Jonas Osei-Adu

DETAILED PROGRAMME FOR THE SCIENTIFIC SESSIONS

Day 4 - May 4, 2016
Yam Technical Session - YTS (Day 4)

	Poster Presentations	
12.45 – 1.30pm	**Title of Paper**	**Lead Author**
	Growth and yield of tissue culture generated seed yams (*Dioscorea rotundata Poir*) on the field	Mavis Akom
	Maximizing Natures Gain: The Yam-Legume Cropping System in Ghana	Felix Frimpong
	Comparative crop water assessment in a yam/legume cropping system using the CROPWAT 8.0 model	Patricia Oteng-Darko
	Advances in Yam Improvement: Relevance, Approaches and Strategies	Felix Frimpong
	In vitro performance of some selected varieties of yam	Agnes Aboagye
	Demystifying Aeroponics :The Gravity-Fed Option for Seed yam Propagation	Patricia Oteng-Darko
	Genotyping of released and elite yam varieties using Simple Sequence Repeats (SSRs)	Bosompem A

DETAILED PROGRAMME FOR THE SCIENTIFIC SESSIONS

Day 5- May 5, 2016
Cocoyam Technical Session - CYTS (Day 5)

	Oral Presentations	
Time	**Title of Paper**	**Lead Author**
9.15 – 9.30am	Progress inTaro (*Colocasia esculenta* (L.) *Schott*) Improvement in Ghana	Lawrence M. Aboagye
9.30 – 9.45am	Preliminary Studies on the development of Simple Sequence Repeats (SSR's) Markers for Cocoyam	Ruth Naa Ashiokai Prempeh
9.45 – 10.00am	On-Farm Evaluation and Farmer Participatory Varietal Selection of Taro (*Colocasia esculenta*) in Ghana	Lawrence M. Aboagye
10.45 – 11.00am	Review of information on genetic resources activities of some root and tuber crops in Ghana	Paul Osei Kofi
11.00 – 11.15am	Invitro Production of Clean Planting Material: Setting the Time Lines	Marian Quain
11.15 – 11.30am	Enhancing germplasm for resistance to Phytophthora leaf blight disease in taro	Daniel Nyadanu
11.45 – 12.00pm	Effect of fertilizer application and plant density on yield and growth of taro	Kennedy Agyemang
12.00 – 12.15pm	Variations in the aggressiveness of *Phytophthora colocasiae* isolates from selected taro	Joseph Adomako
12.15 – 12.30pm	Sustainable Soil and Crop Management Strategies for increased cocoyam production in Ghana	Kennedy Agyemang
12.30 – 12.45pm	Supply chain analysis of cocoyam in Ghana	Patricia P. Acheampong

DETAILED PROGRAMME FOR THE SCIENTIFIC SESSIONS

Day 5- May 5, 2016
Cocoyam Technical Session - CYTS (Day 5)

1.00 – 1.30pm	**Poster Presentations**	
	Developing low technology for rapid multiplication of Taro *(colocassia esculenta* (L.) *schott)* planting material	Regina Sagoe
	Agro-Morphological Characterisation of some Taro (*Colocasia esculenta* (L.) *Schott*.) Germplasm	Lawrence M. Aboagye
	On-farm evaluation of five taro lines towards increased food security in Ghana,	Ernest Baafi
	Collection and conservation of Root & Tuber crops in Ghana	Edmund Owusu

DETAILED PROGRAMME FOR THE SCIENTIFIC SESSIONS

Day 6- May 6, 2016
Sweetpotato Technical Session – STS

	Oral Presentations	
Time	**Title of Paper**	**Lead Author**
9.15 – 9.25am	Evaluation of Six Sweetpotato Genotypes for Enhanced Food Security in Ghana	Kwadwo Adofo
9.25 – 9.35am	The sweetpotato support platform for West Africa: Complementary efforts by the International Potato Center to strengthen sweetpotato breeding in West Africa	Edward Carey
9.35 – 9.45am	Orange-fleshed sweet potato: a potential source of antioxidants and provitamins for the fortification of infant flour	Adama Hema
9.45 – 9.55am	Structure of sweetpotato diversity in West Africa as explained partly by climatic conditions	Kodjo Glato
10.45 – 10.55am	Evaluation Of Resistance Of Sweetpotato Varieties To Cylas Puncticollis Boheman (*Coleoptera*: *Apionidae*) Weevil In Burkina Faso	Koussoubé Souleymane
10.55 – 11.05am	Effect of sowing depths on *Cylas spp* infestation on some sweetpotato varieties	Boamah E. D
11.05 – 11.15am	Effect of compost mounds and chemical fertilizer on yield of sweetpotato	P. Osei Bonsu
11.15 – 11.25am	Potato value chain development with farmers: Its role to avert hunger and attain food security in North-western Ethiopia	Yihenew G. Selassie
11.45 – 11.55am	Analysis of the Main Marketing Constraints for Frafra Potato and their Income Implications for Smallholder Farmers	Romaric Kiswendsida Nanema
11.55 – 12.05pm	Adoption Potential of improved sweetpotato varieties in Ghana	Natson E. Amengor
12.05 – 12.15pm	Etude de référence les filières manioc et patate douce au Mali "Baseline study on cassava and sweetpotato industries in Mali"	Daouda Dembélé
12.15 – 12.25pm	Physicochemical and functional properties of flour from twelve varieties of Ghanaian sweetpotatoes	Charles Tortoe

DETAILED PROGRAMME FOR THE SCIENTIFIC SESSIONS

Day 6- May 6, 2016
Sweetpotato Technical Session – STS

12.45 – 1.30pm	**Poster Presentations**	
	Title of Paper	**Lead Author**
	Detection of sweetpotato viruses on weed species from sweetpotato fields in the forest and Coastal savanna agro-ecologies of Ghana	Allen Oppong
	Boosting Orange fleshed sweetpotato productivity and dissemination of best practices through simple technology in the Eastern Region of Burkina Faso	Macellin Ouedraogo
	Breeding of Frafra Potato for yield, high nutrient composition and resistance to nematodes	Daniel Nyadanu
	Determination of the Effects of Carotenoids Structures on the Conservation of Orange Fleshed Sweetpotato Flour	Mouhoussine NACRO
	Genotyping of released and elite Sweetpotato varieties using Simple Sequence Repeats (SSRs) and Expressed Sequence Tags (ESTs)	Allotey L. A.

ABSTRACTS OF KEYNOTE PRESENTATIONS

Towards a Regional Centre of Excellence: Achievements of WAAPP-NCoS, Ghana

Regina Sagoe

WAAPP-Ghana NCoS Coordinator, CSIR-Crops Research Institute, P. O. Box 3785, Kumasi-Ghana

The West Africa Agricultural Productivity Program (WAAPP) as part of the implementation of the agricultural sector of the Millennium Development Goals (MDGs) aims to support regional cooperation in agriculture in West Africa in accordance with the action plans for managers in the agricultural policy of ECOWAS and NEPAD. This program which started as WAAPP-1A in 2008 and continued as WAAPP-2A in 2013 have contributed to sustainable increases in agricultural productivity in national and regional priority sectors that are more likely to increase the agricultural growth rate of participating countries and also provide support to regional integration as an instrument to promoting shared growth. Reaching this objective implies the strengthening of regional cooperation in the generation of technologies; scaling up dissemination and developing collaborative mechanisms. WAAPP 2A, Ghana is expected to strengthen its National Centre of Specialization in Roots and Tuber Crops (NCoS) to become a Regional Centre of Excellence(RCoE). An ~~a~~doption of consensus and harmonized evaluation criteria workshop in Lome enabled these centers have a benchmark that will guide the transition and facilitate linkages with partner institutions. This presentation reflects the eligible criteria and regulating framework that shall govern the efficient and sustainable operations of the RCoE describes the current status of the CSIR- Crops Research Institute as a NCoS as well as the Institute's achievements as it moves towards a RCoE.

Keywords: Regional Centre of Excellence, National Centre of Specialization, Root and Tuber Crops, Regional cooperation, WAAPP 1A, WAAPP 2A, ECOWAS, MDG

Marketing and Commercialization: Involving the Private Sector in Root and Tuber Crops Value Chain development

Anthony Sikpa.
Yam Development Council, Accra.tonysikpa02@gmail.com

Marketing and commercialization as a driving force for research and development in the Root and Tuber Crops value chain cannot be over emphasized in an economy that is mostly agrarian. And for any real development the private sectors involvement is critical for sustainable development. This paper therefore aim at contributing to the search for sustainable increases in agricultural productivity in national and regional priority sectors, particularly root and tuber crops. It briefly defines the basic concepts of marketing and commercialization and argues for an intervention that places the private sector as dominate actors in the value chain, and the relevant stakeholder networks that must be developed to drive research and development. It further describes the case of the yam value chain, presenting its constraints in development, development pathways and how this can be implemented. Future opportunities are highlighted and conclude by soliciting for institutional support to ensure full engagements with identifiable industries that have full potential opportunities for use of root and tuber crop derivatives.

Keywords: Root and tuber crops, yam value chain, development pathways, marketing, commercialization, private sector.

Value addition to Root and Tuber Crops: the way forward

Ibok Oduro

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The cultivation and consumption of Root and Tubers (R&Ts) is integral to Tropical Africa especially Sub-Sahara. Nigeria is the world leading producer of R&T's followed by Ivory Coast then Ghana. The major R&Ts include yam, cassava, sweetpotato and cocoyam. They serve as calorie rich staple carbohydrate foods and are grown by over 55% Ghanaian farmers. They have great potential for industrial (food and non-food) applications and are major contributors to food and nutrition security. However, they are produced at small holder farmer levels with low productivity and limited diversification of use. R&Ts experience over 50% postharvest losses due to several confounding constraints including limited postharvest management/technology, poor collaboration, supply chain or market system as well as lack of policies or its implementation. One universal approach to addressing these challenges is through value addition. Efforts have been made over the years in the development of improved varieties that could withstand the impacts of pests, diseases and climate change. However, value addition through processing into convenient products is a crucial step in promoting the R&Ts; thus it will increase its utilization and consumption and further generate income, create jobs and boost livelihood. Value addition can be achieved by either product improvement or new product development. The value added products developed from R&Ts should be readily marketed. Value addition to R&Ts becomes fortified when the value chain for developed product is studied. The value chain approach targets reducing the inefficiencies along the food supply chain. A value chain can be described as a series of sequential activities where at each step in the process, the product passing through this chain of activities gains some value. Generally, the chain of activities gives the products more added value than the sum of the added values of all activities. All efforts must be climaxed with strategic promotion and awareness programs to increase its consumption. The end results of these are reduction of postharvest losses, improved livelihood and increased food production. This will ultimately help in the achievement of food and nutrition security in Africa and the world. On the way forward, a multi-stakeholder approach is essential to achieve improvement in the R&T value chain. Effective collaboration/network among the civil society, science/technology, business and the government is key. Thus, a conducive policy environment, and actively involved public services and private sector are prerequisites to improving the value chain and reducing the amount of 'missing' food.

Keywords: Food processing, Multi-stakeholders, New product development, Novel and convenient products, Post-harvest technology, Value chain

Towards Integrated Research and Extension Delivery: A Key for Sustainable Root and Tuber Crops Development

**Stella A. Ennin and Jonas Osei - Adu*
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In recent times, it is becoming evident that development of agricultural innovations that have high impact and are sustainable would require major participation of actors beyond agricultural researchers, extension practitioners and farmers. The concept of Integrated Agricultural Research for Development (IAR4D) is one such broader participatory approach on innovation platforms (IPs) along agricultural value chains, and is enshrined in the Comprehensive African Agricultural Development Programme (CAADP). Outcomes and lessons learnt from some application of IAR4D mainly from Ghana and the West African sub-region within the past decade are discussed in this paper. Positive outcomes have been achieved in food, cash crop and livestock production systems, access to input services, markets, capacity of rural actors and the research and extension system, and policy interventions. These have resulted in significant improvements in livelihoods. Lessons are shared on value chain actors, IP process and innovations, challenges and sustainability issues for application in root and tuber crops development.

Keywords: IAR4D, innovation platforms, lessons learnt, outcomes

Technology and Innovations in Root and Tuber crops Development

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There are many compelling reasons for promoting root and tuber crops for sustainable food production in Sub Saharan Africa: (i) they are versatile staples to address food and nutrition security and produce more food per unit area of land, compared to many other crops; (ii) potato and sweet potato are short cycle crops (3 to 4 months), and thus well suited to the double cropping seasons particularly the rain-fed system; (iii) yam, cassava and cocoyam, though longer in their cropping cycle, are vital in the annual cycle of food availability due to their broader agro ecological adaptation, diverse maturity period and in-ground storage capability, permitting flexibility in harvesting period for sustained food availability; (iv) these crops are also capable in efficiently converting natural resources into a more caloric energy in the growing season, which is the highest of all major arable crops; almost double that of wheat and rice; (v) they are a cheap but nutritionally rich staple foods that contribute protein, vitamin C, vitamin A, zinc, and iron to meeting the dietary demands of the region's fast-growing towns and cities; (vi) they have high demand in local and national markets; (vii) they are far less susceptible to large-scale market shocks and price speculation experienced by more widely traded staples, such as grains, during international market crises (as in the food crisis of 2007–2008). As such they contribute to a more stable food system and predictable source of income. The five crops have common and unique challenges related to quality seed production, new variety adoption, losses due to insects and diseases, low productivity in poor soils, tolerance to stress associated with heat and drought, consumer preferences, and storage of harvested products. Innovations in the root and tuber crops should be about sustainability in production systems that focus on technologies and practices that do not have adverse effects on the environment and how to reduce the drudgery in cultivation in order to attract the youth in agriculture, add value through processing and also find markets for the products. This paper suggests technologies and innovations that can be adopted along the root and tuber value chain towards ensuring food security in the sub region.

Keywords: root and tuber crops, food security, staples, quality seed production, variety adoption

ABSTRACTS OF TECHNICAL SESSIONS

CASSAVA TECHNICAL SESSION

Improving Cassava Productivity through Sustainable Nutrient Management

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Although cassava is the second most important food crop in Sierra Leone, relatively little attention, other than the release of improved varieties, has been paid by the research and development community to better manage its productivity. Currently, cassava farmers do not seem to invest in soil fertility management but look for ways of coping with ever less fertile soils, thereby degrading them to a stage where cropping becomes unprofitable. This are to identify strategies by which appropriate soil management practices can be incorporated into cassava cropping systems to improve its productivity, sustain soil fertility, strengthen its value chain and contribute towards improving food security in Sierra Leone. Field trials were established to determine the primary nutrients that are limiting the productivity of cassava in fallow and cropped soils across several agro-ecologies of Sierra Leone. Across all ecologies, cassava showed significant ($P<0.05$) responses to N, P and K. Cassava yields were significantly higher in fallow sites than in recently cropped sites. Tuber and leaf production were significantly depressed in treatments that received fertilizer combinations omitting N and/or K. Responses to P were not as significant ($P<0.05$). Yields as high as 30t/ha were obtained where all N, P, and K were present as compared to yields as low as 9 t/ha where no N, P or K were applied. It can be concluded that fertilizer or other forms of soil nutrient replenishment can contribute to yield increases, higher farm incomes, possibly to lower consumer prices, leading to improve livelihoods.

Keywords: Integrated nutrient management, cassava, productivity

Croissance végétative et suivi des maladies et ravageurs des hybrides de manioc (*Manihot esculenta* Crantz) issus de semis de graines

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Le manioc (*Manihot esculenta*) est cultivé dans toutes les régions de la Côte d'Ivoire et occupe le deuxième rang des productions vivrières après l'igname avec un volume de 4,24 millions de tonnes. Il est consommé et commercialisé sous diverses formes (attiéké, pâte de manioc, foutou, placali, farine, amidon, etc.) localement et à l'extérieur. Cependant, les variétés cultivées à chair blanche représentent plus de 90 % des surfaces cultivées en manioc alors que les variétés à chair colorée en occupent 10 %. Elles sont pauvres en provitamine A (ou béta-carotènes) alors que les variétés à chair colorée sont riches en provitamine A. C'est dans ce contexte que des travaux de recherche ont été entrepris pour créer de nouvelles variétés à haut rendement, riches en provitamine A et polyvalentes. La présente étude a consisté à analyser la vigueur végétative, les comportements vis-à-vis des maladies et ravageurs et la production racinaire de 13 456 hybrides issus de croisements libres et contrôlés. Les résultats indiquent que les hybrides, qui provenaient de croisements contrôlés entre des variétés améliorées à chair colorée et blanche, ont été plus vigoureux avec un taux de vigueur de 7 % à 100 %, dans l'ensemble, que ceux qui étaient issus de croisements libres (6 % à 50 %). En outre, les hybrides issus de croisements contrôlés avec une variété améliorée comme géniteur ont été moins attaqués par les viroses avec une incidence de 0 à 3 % que ceux provenant de croisements libres avec un cultivar comme géniteur femelle (0 à 20 %). Les différents types de forme et de couleur des organes aériens observés chez les hybrides ont été les mêmes que ceux décrits dans la collection de manioc du CNRA. A la récolte, les hybrides présélectionnés sont composés de 224 hybrides à chair orange, 364 à chair jaune foncée, 332 à chair jaune clair, 152 à chair crème et 54 à chair blanche.

Mots-clés : Manioc, *Manihot esculenta,* croisement, hybride, provitamine A

English Translation

Vegetative growth and monitoring of diseases and pests of cassava (*Manihot esculenta* Crantz) hybrids

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Cassava (*Manihot esculenta*) is grown in all regions of Côte d'Ivoire and is the second largest food crops after yam with a volume of 4.24 million tons. It is consumed and marketed in various forms (attiéké, cassava paste, foutou, placali, flour, starch, etc.) locally and outside. However, the white flesh landraces represent over 90% of cassava area while varieties with colored flesh occupy 10 %. The white ones are poor in provitamin A (beta-carotenes) while the varieties with colored flesh are rich in provitamin A. It is in this context that research has been undertaken to create new high-yielding varieties, rich in provitamin A and multipurpose uses. The present study was to analyze vegetative vigor, behavior and root production of 13 456 hybrids from free and controlled crosses vis-à-vis pests and diseases. Results showed that hybrids, which came from controlled and free crosses between improved varieties colored and white flesh, have been more vigorous with a vigor rate of 7% to 100% overall that those which were from open crosses (6% to 50%). In addition, hybrids derived from controlled crossings with an improved variety as a parent were unless attacked by virus diseases with an incidence of 0-3% than from free crossings with a cultivar as a female parent (0-20%). The different types of shape and color of aerial organs on the hybrids were the same as those described in the CNRA cassava collection. At harvest, the shortlisted hybrids is 224 hydrids with orange flesh, 364 with dark yellow flesh, 332 with light yellow, 152 cream and 54 white flesh.

Keywords: Cassava, *Manihot esculenta*, crossing, hybrid, provitamin A

Caractérisation agro-morphologique des accessions de manioc (*Manihot esculenta Crantz*) cultivées en Côte d'Ivoire

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La caractérisation de la collection permet, la conservation de ressource phytogénétiques de manioc et de disposer d'une large possibilité de caractère en vue de leur amélioration.Quarante-quatre (44) accessions de manioc collectées dans les principales zones de production de la Côte d'Ivoire et cultivées sur la parcelle de conservation des ressources phytogénétiques de l'Université Nangui Abrogoua ont été évaluées au niveau agromorphologique. L'objectif du travail est d'étudier la variabilité phénotypique des accessions et sa structuration sur la base de 26 variables sélectionnées parmi les descripteurs du manioc de l'IITA. La description des différentes accessions (variables qualitatives) et la mesure des paramètres agronomiques (variables quantitatives) ont permis d'établir une classification. L'analyse descriptive a montré des différences phénotypiques importantes entre les accessions pour tous les caractères considérés. Une analyse en composante principale (ACP) a confirmé cette variabilité morphologique à hauteur de 63,84%. La classification hiérarchique ascendante (CHA) a permis de structurer les accessions en trois (03) groupes de diversité morphologique. Le groupe 1 est constitué des accessions de petite taille (168,91 ± 10,09 cm), ramifiées et ayant un nombre de lobe réduit (2,72 ± 0,44). Les individus du groupe 2 sont de grande taille (250,50 ± 4,84 cm) avec un gros diamètre du collet (3,18 ± 0,23cm), mais le nombre de lobeet la longueur du pétiole sont statistiquement identiques àceux du groupe 3 qui sont respectivement 6 lobes et 30 centimètre. Dans le troisième groupe, les individus sont surtout caractérisés pardes variables ayant des valeurs intermédiaires. Les groupes ainsi définis, offrent une grande possibilité de choix pour la création de variétés améliorées de manioc ayant un potentiel de rendement élevé et adaptées à différentes zones agro-climatiques de la Côte d'Ivoire.

Mots-clés : accessions ; agromorphologique ; manioc ; Côte d'Ivoire ; diversité ; caractérisation

English Version

Agro-morphological characterization of cassava accessions (*Manihot esculenta Crantz*) cultivated in Côte d'Ivoire

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Studies on a cassava collection characterization allow the germplasm conservation and a wide possibility of agronomic traits for cassava crop breeding.The objective of the study was to investigate the phenotypic variability of the accessions and its structure on the basis of 26 variables selected among the descriptors of IITA cassava. Forty-four (44) cassava accessions collected in the main production areas of the Côte d'Ivoire and grown on land conservation of plant genetic resources of Nangui Abrogoua University were evaluated on agro-morphological level. The description of the different accessions (qualitative variables) and measurement of agronomic parameters (quantitative variables) were used to classify the accessions. Descriptive analysis showed significant phenotypic differences among accessions for all characters considered. A principal component analysis (PCA) confirmed this morphological variability in the amount of 63.84%. The hierarchical Cluster Analysis (HCA) helped structure accessions in three (3) morphological diversity groups. Group 1 consists of small accessions (168.91 ± 10.09 cm), branched and having a reduced number of lobe (2.72 ± 0.44). Individuals of Group 2 are large (250.50 ± 4.84 cm) with a big collar diameter (3.18 ± 0.23 cm), but the number of lobe and the petiole length are statistically identical to those in group 3which are respectively 6 lobes and 30 centimeter. In the third group, individuals are mostly characterized by variables having intermediate values. The well defined groups offer a wide possibility of choice for the creation of improved cassava varieties with high potential yield and adapted to different agro-climatic zones of Côte d'Ivoire.

Keywords: accessions; agro-morphological, cassava, Côte d'Ivoire, diversity, characterization

Usage of Constructed well in *Garri* Processing Unit in Yaba, Federal Capital Territory, Abuja, Nigeria.

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Populace always sends in cassava tubers to the *Garri* processing unit in Yaba for processing into different product. And this has added to the cassava value chain. This processing unit consist of different process such as drying , peeling, frying and storage systems and makes use of the water well built within its environment .This paper therefore gives all the detail information about the usage of the constructed well, constraints and the effect on the processing of the *Garri*. The methodology of the study involved the taken of the pictures, administration and analysis of questionnaires.

Keywords: *Garri*, processing, well, Yaba

Growth, Development and Yield of Cassava as Affected by Nutrient Status of Mother Plant

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Cassava is a very important staple crop in Ghana, contributing about 22% to the country's Agricultural GDP. About 90% of farmers in eight out of the ten regions in Ghana cultivate the crop due to its ability to grow on marginal lands. The crop has until recently seen little improvement in their husbandry practices. Cassava yields on farmers' fields are low (8-10 t/ha) with potential yields of 30 to 40 t/ha. A major factor contributing to this low yield is the low soil fertility and the poor quality of the planting material. The study investigated the effect of fertilizer application of the mother plant on the growth, development and yield of progenies from these plants. Cassava genotype Dabo was sown in June 2013, at 1 m x I m at CSIR-Crops Research Institute, Kwadaso, Kumasi, Ghana. There were four fertilizer treatments: NPK 30:30:45, 60:30:45, 45:30:45, and Control. The experimental design was a Randomised Complete Block Design (RCBD) with three replicates. NPK was applied at one month after sowing and Muriate of potash three months after planting. The mother plant was harvested in June, 2014. Cassava yields for all the fertilizer treated plots were significantly ($p \leq 0.05$) higher than the control plot (12.1 t/ha) with yield difference ranging between 68% (20.3 t/ha) and 278 % (33.7 t/ha) in the first year. Cuttings from the mother plants were planted with no fertilizer application in July, 2014. Progeny from the treatment that gave the highest yield in Year 1 (45-30-45, N:P:K) gave the greatest yield (24.0 t/ha) relative to the control (10.3 t/ha), 233 % higher. Commercial cassava planting material producers should boost the quality of the cassava planting material through fertilizing the mother plant. Farmers can also fertilize a small portion of their cassava farm and use cuttings from the fertilized plot as planting material.

Keywords: cassava, fertilizer, planting material, potential yields.

Enzymatic polymorphism of genetic diversity in cassava (*Manihotesculenta*Crantz) accessions in Côte d'Ivoire

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Cassava (*Manihotesculenta*Crantz) is the second most important food cropin Côte d'Ivoire,with a total production of 2.41milliontons. However due to the high rate of adoption of improved cassava varieties, farmers have neglected the local landraces and this has contributed immensely to the loss of cassava genetic material. The objective of this study was to evaluate the diversity and genetic relationships between cassava accessions using enzymatic markers. Cassava planting material consisting of 327 accessions were collected and held in a germplasm bank at Centre National de Recherche Agronomique (CNRA). Enzymatic characterization was performed using enzymatic descriptors: acid phosphatase (PAC), Esterase (EST), Malatedehydrogenase (MDH) and Phosphoglucoseisomerase (PGI). Polymorphism was observed among the enzymatic systems. Total of five heterozygous alleles were revealed with two from the unique PGI enzymatic system and the three others were identified as unique. Among polymorphic alleles evidenced, those from PGI, PAC and MDH expressed a dimeric state with two loci. At the opposite, the polymorphic EST alleles showed a monomeric form. Three enzymatic systems (PAC, MDH, and PGI) identified duplicates of cassava. A total of high yielding genotypes were recommended to farmers nationwide.

Keywords: cassava, enzymatic characterization, enzymes electrophoresis, genetic diversity, *Manihot esculena.*

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Evaluation of released cassava varieties for delayed Postharvest Physiological Deterioration (PPD)

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Postharvest Physiological Deterioration (PPD) is a phenomenon that affects the quality of cassava roots leading to economic loss as a result of its short shelf life. It starts 24-72 hours after harvest and subsequently the roots change colour rendering them unpalatable and unmarketable. Genetic variability for PPD exists among cassava varieties hence selecting genotypes with delayed PPD is an alternative to ensuring increasing cassava root shelf life after harvest. The focus of this study was to identify suitable cassava varieties among 6 released varieties and 2 checks and their link to dry matter content (DMC). Roots were harvested 10 months after planting (MAP) and evaluated for their reaction to PPD at 3 and 7 days after harvest (DAH) using Booth's method. Analysis of variance (ANOVA) showed no significant differences ($P < 0.05$) among varieties at 3DAH although there were significant differences among varieties at 7DAH. PPD assessment at 3DAH, ranged from 13.8% in one of the checks *Ampong* to 33.7% in variety *Duade Kpakpa*. None of the released varieties had PPD scores lower than the check *Ampong* however, 5 of them had lower PPD scores than the other check *Debor* (22%). PPD at 7DAH ranged from 19.3% in *Lamesese* to 41.4% in the check *Debor*. All the varieties were better than the check *Debor*, and only 2 of the released varieties were better than the check *Ampong*. Significant differences were observed in evaluation periods (3 and 7DAH) for both variety and time whilst there was no significant difference for the interaction between variety and time ($P \leq 0.05$). Consequently, varieties *Lamesese* and *AGRA Bankye* had excellent delayed PPD at 7DAH hence can be widely promoted and used for improving other farmer preferred varieties. There was significant positive correlation between PPD and dry matter content ($R^2 = 0.426$, $P < 0.01$).

Keywords: Correlation, Genetic, Postharvest Physiological Deterioration, Shelf life, Variability

Paramètres morpho-physiologiques de sélection *in vitro* de génotypes de manioc tolérants à la salinité

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Au Sénégal, les surfaces emblavées pour la culture du manioc ne cessent d'augmenter pour atteindre un objectif de production de 3 millions de tonnes. L'expansion de cette culture dans les zones marginales affectées par la salinité de l'eau et/ou du sol nécessite la sélection de matériel végétal tolérant à ce stress abiotique. L'objectif de ce travail a consisté à identifier des critères fiables pour classer des accessions de manioc selon leur degré de tolérance à la salinité. Pour se faire, quinze accessions de manioc collectées dans les six zones agro-écologiques du Sénégal ont été criblées en conditions *in vitro* en présence de différentes concentrations de NaCl (0 ; 1 ; 1,5 ; 2 ; 2,5 et 3 g/l) incorporées dans le milieu de culture. Les paramètres morpho-physiologiques mesurés ont porté sur la hauteur des vitroplants, les poids frais et secs des parties aériennes et racinaires, l'aptitude à l'enracinement des explants et les teneurs en chlorophylle a, b et totale dans les feuilles. Les résultats obtenus ont révélé que la partie aérienne des vitroplants est plus sensible aux effets dépressifs de la salinité que la partie racinaire. Deux seuils de sensibilité critiques aux effets néfastes de la salinité ont été identifiés à 2 g/l et 1,5 g/l de NaCl respectivement pour les paramètres morphologiques et physiologiques. La concentration de NaCl à 2 g/l est le seuil critique de sensibilité permettant de classer les accessions en groupes tolérant, moyennement tolérant et sensible. Cette classification a été confirmée par les mesures de paramètres de biosynthèse des chlorophylles mais pour un seuil de sensibilité bien inférieur (1,5 g/l). Le fonctionnement physiologique des vitroplants de manioc apparaît donc prioritairement révélateur de leur sensibilité au NaCl. Ces résultats peuvent être utilisés pour un criblage à grande échelle d'accessions de manioc vis-à-vis de la salinité.

Mots clés : manioc, *in vitro*, Sénégal, tolérance à la salinité.

English Translation

Morphophysiological parameters for *in vitro* selection of cassava genotype tolerant to salinity

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In Senegal, cassava production has been increasing to reach a target of 3 million tons. The production of cassava in marginal areas affected by the salinity of water and /or soil requires the selection of tolerant planting material to abiotic stress. The objective of this work was to identify reliable criteria to classify cassava accessions according to their tolerance to salinity. Fifteen cassava accessions collected in the six agro-ecological zones of Senegal were screened under *invitro* conditions. Different concentrations (0, 1, 1.5, 2, 2.5 and 3 g/l) of Salt (NaCl) were incorporated in the culture medium. The morphophysiological parameters measured were height of the plantlets, fresh and dry weight of shoot and root biomass, the ability to rooting of explants and chlorophyll content, a, b and total in the leaves. The results revealed that the shoot part of the plantlets was-more susceptible to depressive effects of salinity than the root. Two thresholds of critical sensitivity to the adverse effects of salinity were identified to 2 g/l and 1.5 g/l NaCl respectively for the morphological and physiological parameters. NaCl concentration of 2 g/l was identified as the critical sensitivity threshold for classifying accessions tolerating groups, moderately tolerant and sensitive. This classification was confirmed by the biosynthesis of parameter measurements of chlorophyll but at a much lower sensitivity threshold (1.5 g/l). So, it appears that the physiological functioning of cassava plantlets is the first parameter revealing the sensitivity to NaCl. These results can be used for a large-scale screening of cassava accessions in saline condition.

Keywords: cassava, *in vitro*, Senegal, tolerant to salinity.

Additive main effect and multiplicative interaction analysis and estimation of geneticcomponents of growth and yield of cassava in two ecologies in Ghana

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Studies were carried out in the Guinea savannah and forest ecologies of Ghana to assess the ability of yield and some growth parameters of cassava for two seasons. Twenty diverse cassava genotypes were arranged in a randomized complete block design with three replications at each location and in both years. Yield stability was assessed using the additive main effect and multiplicative interaction (AMMI) analysis. AMMI stability value (ASV) was used to rank genotypes based on yield. The results indicated highly significant effect ($P<0.001$) of genotype, environment and genotype by environment interaction for all traits studied. The AMMI analysis of variance indicated that genotype accounted for 51% of the total variation for height at branching whilst environment and interaction accounted for 33% and 15% respectively. In the case of fresh root yield, environment accounted 37% of the total sum of squares whilst genotype and interaction accounted for 32% and 29% respectively implying strong environmental influence. A greater proportion of the phenotypic variance for harvest index (HI) and plant height was accounted for by the genetic components giving indication of the inherent genetic variation for these traits. Storage root yield and dry matter were influenced by their genotypic variances more than the interactions indicating that remarkable genetic improvement can be made with selection. AMMI stability value ranked *ATR002* and *96/409* as the most stable genotypes across both environments and years. Genotypes *UCC2001/449* and *96/1708* though high yielding were among the unstable ones according to ASV score. These genotypes are recommended for further testing in more environments to ascertain their broad and specific adaptability to boost cassava production and ensure foods security.

Keywords: Additive main effect multiplicative interaction, AMMI stability value, cassava, genotype x environment interaction, yield stability.

In Vitro Conservation of *Manihot esculenta spp* (Cassava) Genetic Resources in Ghana

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Manihot esculenta spp. (cassava) contributes significantly to global food security and serves as a major carbohydrate source in Ghana. It also provides raw material for the cassava industry. Cultivation of released cassava varieties, climate change and natural habitat destruction among others, causes loss of genetic diversity in cassava. Crop diversity is important for food security. Conservation of cassava genetic resources will ensure that their diversity is maintained for crop improvement and future use. Cassava genetic resources are conserved ex situ in field genebanks and under in vitro slow-growth conditions as tissue cultures or by cryopreservation. This paper highlights the in vitro conservation activities carried out on cassava genetic resources held at the PGRRI. The cassava genetic resources collection at the Plant Genetic Resources Research Institute (PGRRI) of Ghana consists of accessions acquired from collecting missions carried out across the country, accessions from other countries and some released varieties. Cassava tissue cultures are initiated from nodal cuttings excised from young shoots collected from the screen house. Explants are surface sterilized and inoculated on Murashige and Skoog's tissue culture medium supplemented with 3% sucrose and gelled with 0.8% bacteriological agar. Benzylaminopurine and Napthaleneacetic acid are added at 0.05 mg/l and 0.01 mg/l respectively. In vitro cultures are incubated at 25 ± 1 °C and 16/8 hours day/dark photoperiod provided by florescent light. The in vitro cassava collection is maintained by periodic culturing of nodal explants excised from old plantlets of each accession at six months intervals. A minimum of seven nodal cultures per accession are prepared with each subculture cycle. Presently 241 cassava accessions are kept as tissue culture plantlets under slow growth conditions in the in vitro genebank of PGRRI. Nine of the in vitro conserved materials are released cassava varieties.

Keywords: Cassava, conservation, genetic resources, in vitro, tissue culture

A preliminary investigation into Cassava root rot disease in the Brong Ahafo region of Ghana

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Cassava root rot diseases are major constraints to cassava production in many cassava producing countries in Africa. Yield losses of up to 80% due to these diseases have been reported. In Ghana, there have been reports of high incidence of cassava root rot disease in many rural communities of the Brong-Ahafo region of Ghana where cassava is a major source of income. The objective of this study was to determine the type of cassava root rot disease; the incidence of the disease and the cultural practices that favour the spread and persistence of the disease in the Brong Ahafo region. Multi-stage random sampling technique was used to identify and interview 35 farmers from the Forest, Humid Savanna and Transition zones of the Brong Ahafo region on their production practices and cassava varieties grown. Cassava farms of the respondents were sampled for diseased roots and diseased samples were collected for laboratory investigations. Cassava dry root rot caused by *Lasiodiplodia theobromae* was the most prevalent root rot disease in the Forest, Humid Savanna and Transition zones of the Brong Ahafo region. Disease incidence ranged from 5 and 10%. Infected farms had been cropped with cassava continuously for at least three years and both sole crop cassava and intercropped cassava were affected. Depending on the variety of cassava cultivated, mature plants aged one to one and a half years were infected. Delayed harvesting and poor farm sanitation enhanced the spread and persistence of the disease. Findings from this study indicate that inappropriate farm management practices increases the occurrence, spread and persistence of cassava dry root rot disease. These findings will facilitate the design of appropriate management strategies for cassava dry root rot disease.

Keywords: *Manihot esculenta* Crantz., Forest zone, Transition zone, *Lasiodiplodia theobromae,* farm management practices

Performance of an Improved Manual Cassava Harvesting Tool as Influenced By Planting Orientation and Cassava Variety

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Cassava has over the years become an important food security crop in Ghana and in most parts of sub-Saharan Africa; making it the single most important source of dietary energy. Harvesting, which is one of the serious bottlenecks in the cassava production value chain, has received little attention in terms of mechanization. Earlier attempts at mechanizing cassava harvesting have been challenged mainly by inappropriate methods of planting, field topography and scale of cultivation. The objective of this study was to evaluate the efficiency of an improved manual cassava harvesting tool under three different planting orientations for four cassava varieties in terms of field capacity, level of drudgery and root tuber damage. Force requirement in uprooting the different cassava varieties was also determined. The study was conducted at the Crops Research Institute research field, Fumesua. Field capacity of improved manual harvesting tool ranged from 49.9-156 man-h/ha, root tuber breakage from 4.32-19.55% and harvesting energy consumption ranging from 470.34-773.72 W across cassava varieties and planting orientations. *Nkabom* cassava variety was the easiest to uproot irrespective of the planting orientation whereas *Sikabankye* variety offered the best in terms of root tuber damage and drudgery. Again, it was faster harvesting vertically planted cassava though cassava planted slanted offered the least root tuber breakage and drudgery, regardless of cassava variety. Cassava uprooting force ranged from 86.8-143.3 kg, rooting depth ranged from 22.39-26.86 cm and cassava yield per plant ranged from 5.84-13.14 kg. Further research to identify the relationship between uprooting force requirement and some cassava agronomic parameters is recommended.

Keywords: Cassava, drudgery, field capacity, planting orientation, tuber breakage, uprooting force

Cassava as an Industrial Crop: The DADTCO Experience in Ghana

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DADTCO was established in the year 2002 and has been working with farmers in the developing world mainly Nigeria, Mozambique and Ghana. DADTCO Development concentrates on making the small farmer independent in developing countries, especially in Africa. It helps the farmer to move ahead by enabling him to manage his own affairs. DADTCO uses a new technology called Autonomous Mobile Processing Unit (AMPU) which is a mobile cassava processing unit, which offers a flexible and robust solution to logistical and quality struggles in the cassava flour and starch industry. Installed in two 40ft containers, and equipped with a 220KVA genset, the unit can be operated independently, and can be moved from platform to platform as the need arises, processing the harvest within the local farmers' mobility range of 20 km. DADTCO has operated an AMPU between 2012 and 2014 in the Eastern and Volta Regions to supply cassava cake to Accra Breweries Limited (ABL). The new business case for DADTCO in Ghana is premised on two markets: (1) beer breweries, notably GGBL and ABL, to replace starch imports and (2) bakery sector to reduce wheat imports. In 2015, DADTCO realized several important technological breakthroughs. It developed the Mobile Refinery Unit (MRU) and the Mobile Drying Unit (MDU), which can be added to the AMPU, to produce Cassava Starch Flour. Cassava Starch Flour is easier to handle and therefore much more readily accepted by the food industry and bakery sector than cassava cake. "Bringing the factory to the farmers" translates in tremendous savings and increased security of supply. Cassava Starch Flour represents less than a quarter of the roots volume and can be stored for over a year. A single mobile processing plant, rotating between three areas to source roots from surrounding smallholder farmers, can produce up to 20 tons of Cassava Starch Flour per day, i.e. roughly 6,000 tons per year. DADTCO has been facing a lot of challenges and hopes to overcome them with the new technologies developed thereby responding appropriately to the needs of the Ghanaian market.

Keywords: Autonomous Mobile Processing Unit (AMPU), Cassava industry, DADTCO

The effect of cassava plant architecture on crop productivity in various cassava-maize cropping systems in Sierra Leone.

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Field experiments were conducted at the experimental sites of SLARI in Foya, Rorinka, Samu and Serabu during the 2014 main cropping season to evaluate the effect of cassava plant architecture on crop productivity in various cassava-maize cropping systems in Sierra Leone. The experimental design was a split plot design with three replications. Two cassava varieties i.e. *SLICASS1* (branching) and *SLICASS7* (erect) were assigned to the main plots. Eight cropping systems, i.e. sole-cassava, sole-maize, cassava intercropped with maize at 1mx1m, 2mx0.5m, 1mx0.75m, 1.5mx0.5m, 2mx0.75m and 1.5mx1m spatial arrangements of cassava were randomly assigned within the subplots. The sole-crop of cassava produced the highest tuberous root yield (21.78kgha-1) which was not significantly different from the tuberous root yield (21.41kgha-1) in the 1.5mx0.5m cassava-maize intercropping system. Tuberous yield (18.73kgha-1) in erect variety (SLICASS7)was significantly higher than the tuberous root yield (16.71kgha-1) in the branching variety (SLICASS1).The grain yield in the sole-crop of maize was not significantly different from those obtained when intercropped with cassava at 1.5m x1m, 2mx0.5m and 2mx0.75 spatial arrangements. Intercropping cassava with maize efficiently used the land in all the cassava-maize intercropping systems. The erect variety (SLICASS 7) when intercropped with maize at 1.5 m x 0.5 m spatial arrangement of cassava gave the highest land equivalent ratio (1.96), increase in net income (Le9, 133.000.00) and benefit cost ratio (1.66). To achieve increased crop productivity in cassava-maize cropping systems, the study recommends intercropping the erect cassava variety (SLICASS 7) with maize at 1.5 m x 0.5 m spatial arrangement of cassava.

Keywords: cassava-maize, crop productivity, intercropping systems, plant architecture

Growth Performance of Grasscutters (*Thryonomys swinderianus*) in Captivity Fed on Pelleted Forage and Cassava Tubers with the Peel in Ghana

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The study was to investigate the growth performance and quality of the meat of grasscutters in captivity fed on two pelleted diets made of Elephant grass, *Gliricidia* leaves and cassava with the peel with urea as ration 1 and with soy bean meal as ration 2. The control was feeding with only Elephant grass. Feed intake, feed wastage, weight gain were measured and feed conversion ratio was calculated. Feed intake and feed conversion ration were not significantly different at $P \leq 0.05$. Although the feed intake of the experimental animals was low on the pelleted feed their growth rate was numerically higher as compared to those fed on the Elephant grass (*Pennisetum purpurenum*) only. The final body weights of the animals fed on the pelleted feed were not significantly different but significantly different from those fed on the control feed $P \leq 0.05$. Grasscutters are noted for their feed wastage, in the study feed wastage of the three rations were significantly different $P \leq 0.05$. With the control feed recording the highest feed wastage. The dressing percentage of carcass as well as the protein content of the meat of the animal fed on the pelleted diets were not significantly different but were significantly different to those of the control ($P \leq 0.05$). It was also observed that it would cost GH₵ 21.70 for one kilogram weight gain feeding the grasscutter with Elephant grass whilst with the pelleted feed it would cost GH₵ 9.83 and GH₵ 6.85 for ration 1 and ration 2 respectively feeding the grasscutter. Grasscutter farmers in Ghana are encouraged to feed their grasscutters with pelleted combination of Elephant grass, *Gliricidia* leaves and cassava with the peel with either urea or soy meal with other commercial ingredient as complete diets for sustainable grasscutter production in Ghana and countries south of the sub-Saharan region.

***Keywords**:* Growth Performance; Grasscutters (*Thryonomys swinderianus*); Meat Quality.

Improving the multiplication rate of tissue culture acclimatised cassava planting materials under screen house conditions

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Cassava has become a food security and industrial crop in Ghana and West Africa in general. Access to clean planting materials for vegetative propagated crops like cassava is essential to sustain productivity. Experiment was conducted under screen house conditions using four released farmers' preferred varieties of cassava namely *Broni Bankye, Sika Bankye, Ampong and Otuhia*. Shoot tips (about 8.0 cm cuttings with about 5-6 nodes depending on variety) of these varieties of already acclimatized tissue culture derived plantlets were excised using sterile blade (surgical blade). These excised cuttings were root induced using different levels (0.005 mg/L, 0.010 mg/L, 0.015 mg/L) of IAA, NAA and deionised-autoclaved water (control) as treatments. Data was taken at day 7 to day 21 on the following parameters: % survival in soil after transfer in potted-soil, number of roots, extent of vigour, number of new leaves, number of internodes, plant height. Data was analyzed using R-Statistical software version 2.2. Results indicated that the control (sterile water) was statistically significant and had impact on plant survival in soil with regression coefficient of 38.05 at p = 0.003; however, the different levels of treatment of NAA and IAA had no statistical impact on plant survival in soil. This simple method can be adopted to scale up the numbers in generating cleaned cassava planting materials for field establishment.

Keywords: Acclimatization, cassava, multiplication, rooting, tissue culture

Induction of Embryogenic Structures and Plantlets Regeneration in Local Cassava (*Manihot esculenta CRANTZ*) Varieties

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Cassava (*Manihot esculenta Crantz)* is an important food crop for over 500 million people in developing countries. Its production is constrained by diseases including cassava mosaic disease and cassava brown streak disease. This study aims to screen a range of agronomically important Cameroon cassava genotypes for their ability to regenerate plants. Immature leaf lobes (ILL) and apical meristem (AM) were excised from 4-week-old in vitro plantlets of landraces *SK, NM, LW, LR and LRE* and placed on medium containing 12 mg/l Picloram (CIM) for inducing primary somatic embryos. Secondary and subsequently cyclic somatic embryos were produced. Somatic embryo clusters were divided into small clusters and transferred into maturation medium (CMML). Young green cotyledon pieces were fragmented and cultured in organogenesis medium (COM). The regenerated shoot buds were transferred into cassava elongation medium (CEM) and finally to hormone-free medium (CBM) for rooting. The recovery plantlets were transplanted into soil and acclimatized in greenhouse. Somatic embryogenesis (SE) was successfully achieved within 3-4 weeks. Frequency of primary somatic embryogenesis varied from 20 to 60%. *NM* exhibited the highest number of SE (90) while the lowest was obtained with *LRE* (17). All cassava landraces formed secondary somatic embryos at a higher frequency than primary somatic embryos. However, the average number of SE was genotype- dependent and ranged from 20 to 41 with *SK* and *LW* expressing the highest number. *SK* and *LW* exhibited highest frequencies of buds induction under photoperiod condition. With *NM*, higher frequency of buds induction was observed in dark condition. Similar frequencies of buds induction were obtained under the two light regimes with *LR* and *LRE*. Average number of buds per explant was higher under photoperiod condition with all the varieties tested. Maximum buds per explant was expressed by *LRE* (19.67) and LR (18.80) indicating a Lack of relationship between the response of a genotype to somatic embryogenesis induction and shoot regeneration. Shoots of all the cassava genotypes tested grew into plantlets and rooted with high efficiency. The regenerated plants were well established in greenhouse with a survival rate of 90 to 100%. Results show that the cassava cultivars from Cameroon are amenable to regeneration and thus increasing the range of African cassava cultivars that can be engineered using recombinant DNA technologies

Keywords: cassava, cyclic somatic embryogenesis, mosaic disease, somatic embryogenesis

Utilisation des méthodes de la culture in vitro pour conserver, multiplier et distribuer des boutures assainies, indemne du Virus de la Mosaïque du Manioc en Afrique de l'Ouest et du Centre

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Le manioc (*Manihotesculenta*) est une culture à grande utilité alimentaire et économique. Il occupe une place de choix dans le système agricole, car il vient en deuxième position après le maïs. Au Bénin, le manioc est le principal pourvoyeur en calories de repas parmi les plantes à racines et tubercules. Le manioc a renoué avec une croissance régulière de la production au cours de cette décennie. Toutefois, sa culture est confrontée à de nombreuses maladies. En effet, ces dernières années, l'incidence des maladies, notamment la forte pression de la mosaïque et de l'anthracnose, s'est accrue dans les champs communautaires. Les résultats fournis par la Direction de l'Agriculture (DAGRI), la Direction de la Promotion de la Qualité et du Conditionnement des produits agricoles (DPQC) et les Centres Régionaux pour la Promotion Agricole (CARDER) font état d'une forte pression de l'anthracnose, de la mosaïque et de cochenille farineuse. Cette situation, qui est vécue dans la plupart des pays de l'Afrique de l'Ouest et du Centre, compromet dangereusement la production et partant la sécurité alimentaire. En vue de l'éradication de ces fléaux, le renouvellement du pied de cuve du matériel végétal de manioc était devenu une nécessité. Dans ce cadre, la culture in vitro a été utilisée pour obtenir des boutures assainies, indemne du Virus de la Mosaïque du Manioc en Afrique de l'Ouest et du Centre ». Le présent article fait état de l'activité de conservation, de multiplication et de diffusion de ces boutures de manioc au Bénin.L'objectif du Béninétait le renouvellement du matériel de plantation de manioc, fortement dégradé et hautement susceptible à la forte pression parasitaire. Financé le CORAF/WECARD pour la première année, puis par le PPAAO/WAAP pour la seconde année, le projet a permis de produire 140.000 tiges de base de vitroplants de manioc des variétés RB 89509 et BEN 86052 par le Centre de Recherches Agricoles Sud (CRA-Sud) de l'INRAB, partant des vitroplants de manioc produits par le Laboratoire de Génétique et des Biotechnologies de la Faculté des Sciences Techniques (LGB/FAST) de l'Université d'Abomey-Calavi. Ces tiges de manioc issues de vitroplants ont permis à des producteurs multiplicateurs de boutures de manioc, d'emblaver une superficie totale de 60 ha en milieu paysan, dans les 5 départements du Sud-Bénin que sont l'Atlantique, le Couffo, le Mono, le Plateau et le Zou. Les perspectives sont de former les producteurs multiplicateurs des départements producteurs de manioc du Bénin sur l'acclimatation des vitroplants de manioc en vue de vite couvrir les besoins exprimés.

English version

Using *in- vitro*methods to preserve, multiply and distribute clean cuttings, free from the Cassava Mosaic Virus in West and Central Africa

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Cassava (*Manihot esculenta*) is a food crop with high economic value. It is the main source of carbohydrates in West and Central Africa. However, in recent years, the high incidence of diseases, such as cassava mosaic and anthracnose, has become a problem of great concern to farmer's fields threatening cassava production and hence food security. The aim of this study is to use *in- vitro* methods to preserve and multiply clean cassava cuttings and distribute them to farmers in Benin. *In-vitro* culture was used to get clean cuttings, free from the Cassava Mosaic Virus; Healthy plants have been sought through apical meristem tip in vitro culture of vitroplantlets obtained from nodal explants of diseased material. This was performed in three phases: 1) Outgrowth or organization of the apex over a paper bridge on a mineral solution of Margara ("N 30 K"), including a cytokinin (BAP 8.88 µmol/l), an auxin (IBA 0.049 µmol/l) and gibberellin (GA32.9 µmol/l); 2) Lengthening and multiplication of leafed buds benefited from one subculture on a mineral solution of Murashige and Skoog with half diluted macro elements (MS/2) BAP (0.88 µmol/l) and IBA (0.049 µmol/l and gibberellin (0.29 µmol/l); 3) Shoots which had grown enough were rooted by dipping in a solution of sucrose (80 g/l) and ANA (2.67 µmol/l). The vitroplantlets were directly transferred in horticultural substrate. A total of 140,000 base stems from cassava plantlets of varieties *RB 89509* and *BEN 86052* were produced. These plantlets were sown on a total area of 60 ha on farms in the 5 areas of southern Benin which are Atlantic, Couffo, Mono, Plateau and Zou.

Keywords: Benin, cassava, in vitro plants, producers.

Survey on the Occurrence and Distribution of Major Cassava arthropod pests in Sierra Leone

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This survey was conducted to identify and map major cassava insect pests and to determine their prevalence, incidence, severity and distribution in the major geo-political districts of the country. A total of 171 cassava farms were visited country wide during the rainy season survey whilst a total of 193 farms were visited during the dry season survey with an average of 15 farms per district. The result of the survey reveals significant differences in percentage incidence, severity score and prevalence of the major cassava pests with respect to district, cassava variety and season. Percentage incidences and severity scores of the major insect pests were higher on local cassava varieties in most of the districts compared to improved varieties. The Population of the assessed insect pests was generally higher during the dry season compared to the rainy season. The population of grass hopper one of the most destructive insect pests of cassava was generally higher and more damaging in the southern and eastern regions of the country compared to the Northern and Western Area of the country. The outcome of this survey will benefit cassava farmers; as the key insects pests; identified from the survey will serve as guide in the training of cassava farmers in the management of these insect pests which will subsequently lead into increase in yield and income of farmers.

Keywords: Arthropods, survey, Prevalence, Distribution, Incidence, Occurrence

YAM TECHNICAL SESSION

Yam value chain research and development in West Africa: past, present and future

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In West Africa, Yam is an important staple food crop in Nigeria, Ghana, Cote d'Ivoire, Benin, Togo, produced both for cash crop and household consumption. Nigeria is the largest world producer contributing approximately two thirds of the global production. Although the quantities traded are relatively small compared to the overall production, Ghana is the first overseas exporter of ware yam tubers and there is hope to improve the performance of the yam export. The two countries, having a comparative advantage of increasing their Gross Domestic Product from yam production and sales, that should culminate in improved standards of living. However, this is yet to be achieved, due in part to lack of business-efficient and sustainable value chain structures, ranging from production through processing and storage, marketing etc. A number of national and international projects have looked at the research and development components of yam value chains. The yam production in Ghana and Nigeria is constrained by scarcity of quality seed, inadequate mechanization, improved varieties and agronomic practices leading to low yield with yam productivity level from recall-based information estimated at about 7t/ha and 9.4t/ha respectively in Ghana and Nigeria. Processing is mostly affected by bad quality or sub-standard harvests, preservation technologies and uncontrolled dormancy. In marketing, challenges of bad road networks, transportation, middlemen, non-regulated price of yams by governments either by weight or volume are challenges to sustainable value chains, which have negative consequences on profits from both local and export markets. Yam Improvement for Income and Food Security (YIIFSWA) was designed to assess and understand the yam based systems in order to increase yam productivity and impact on food and income in Ghana and Nigeria through research for development opportunities of interventions, involving an integrated approach of value chain analysis (VCA). A preliminary, rapidVCAfollowed by in-depth analyses were carried out in both countries for better understanding of value chains of yam production (ware and seed yam), marketing system and postharvest system including processed products (traditional and industrial products). VCA data collected included costs of production, seasonal yam selling price fluctuations, input supply systems, transport costs, and existing ware yam, seed yam, and processed yam markets. It also highlighted key actors involved at different stages of yam value chains. In addition, a baseline study was conducted in each country aiming at understanding farmers' livelihoods in yam-growing areas to serve as benchmarks to assess changes brought by YIIFSWA project in the future. Key economic and social indicators' measures were taken before implementation of the project. During the VCA, farmers expressed that the lack and cost of seed yam is a constraining factor to expand production. Whilst in many parts of West Africa, farmers mainly rely on locally available seed yam; there are locations where specialized seed markets have been established (e.g. Illushi seed yam market in Edo state). Yam production is a profitable business and farmers are able to generate substantial income from the production of tubers. At the same time, production costs tend to be high (in particular for seed yam and hired labour) and prices depend on the season. Preliminary value chain assessments and mapping identified locations and characteristics of ware and seed yam production systems, principal markets, and relevant organisations and institutional actors. Subsequent studies of yam production and marketing systems have been carried out in the identified project locations. Analysisindicates some differences in each area, some specialisations (e.g. in seed yam or dried yam production), but also many similarities, in particular regarding the main issues and challenges facing production and marketing actors.Yam is still regarded as a luxury good and large tubers can particularly attract high prices often purchased for celebrations such as weddings.At the same time, there are several traditional yam products in West Africa, which are mainly being used for the preparation. New, improved dried yam products have relatively recently entered the market in Nigeria (e.g. poundo yam; yam flour). Key research products include novel technologies for sustainableseed yamproductionsystems, producing clean seed yam, Quality Management Protocol and standards, optimum storage technologies, processing for healthy food and agronomic practices, improving breeding methods and development and release of improved varieties. Translating these research products and technologies to development that will bear on improved living standards will require public sector-enabled, private sector-led businesses, building capacities at low, medium and high-skilled and strengthening national and regional partnerships. These research and development efforts will further facilitate the increase food (yam) security, availability and profitability by farming families.

Seed Yam Production at Bunso

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The research was conducted at the Conservation fields of Plant Genetic Resources Research Institute at Bunso. (There should be a brief statement on the methodology and purpose of this study) During the study, it was observed that *Dioscorea alata* has the highest sprouting rate of 99%, followed by *D. esculenta* at 87%, D. rotundata at 82% and D. cayenensis at 47%. On the establishment and survival rate, it was found that, *D. alata* had the highest establishment and survival rate of 90%, *D. esculenta* at 85%, *D. rotundata* at 83% and *D. cayenensis* at 56%. An economic analysis of production of the crop using data collected and market survey in two yam production centres showed very attractive net returns. So, in a perfectly competitive system, seed yam production could be said to be economically efficient/viable. If Ghana wants to maintain lead in yam exporting, the unemployed youth should be encouraged to train in seed yam production.

Keywords: Seed yam, Production

Producing Yam for Export: The Influence of Seed Sett Size and Planting Density On Tuber Size

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The study was conducted to evaluate the effect of planted seed sett sizes and planting density on the tuber size and yields of yam. The treatments were arranged in a split-split plot design with two premium *Dioscorea rotundata* varieties (*Pona and Dente*) as main plot. Seed sett sizes (farmers' sett size – 350g, half farmers' sett size – 175g) as subplot and Planting density (6944plt/ha; 8333plt/ha; 10417plt/ha; 13889plt/ha; 20833plt/ha) as sub-sub plot in 2014. Seed set size of 50g mini-setts was added in 2015. The results revealed no significant interactions in the 3 way and 2 way factors. However, seed set size and planting density had significant ($P< 0.05$) effect on tuber sizes and yields. Whiles mini-sett – 50g had a significantly lower average tuber size of 0.22kg/tuber, farmers' sett size – 350g and half farmers' size – 175g had similar and bigger average tuber sizes of 2.04kg/tuber and 2.02kg/tuber respectively. Similar trends were observed on tuber yields with farmers' sett size – 350g and half farmers' size -175g recording similar and significantly higher yield of 24.23t/ha and 22.85t/ha compared to mini-sett – 50g which had lower yield of 3.94t/ha. Low planting densities (6944 – 8333plt/ha) and high planting densities (10417 – 20833plt/ha) recorded tuber sizes ranging between 2.48 – 2.55kg/tuber and 1.6 – 2.0kg/tuber for 2014 and 2.51 – 1.95kg/tuber and 1.47 – 1.11kg/tuber in 2015. Although all the planting densities for the farmers' sett size – 350g and half farmers' sett size – 175g had sizes between 1.3 – 2.46kg/tuber which are within the small and medium sizes categories of the export market criteria, the yield per unit area suggest planting density of about 20000plt/ha on ridges would be more profitable. Also the similar tuber size and yield of half farmers' sett size – 175g to that of farmers' sett size – 350g suggest the current sett sizes used by farmers can be reduced to half to maximize profit.

Keywords: Export market, Farmers' sett size – 350g, Half farmers' sett size – 175g, Tuber sizes

Improved Agronomic Practices for Sustainable Yamproduction: The On – Farm Experience

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Yam production in Ghana and other West African countries are characterized by shift from land to land in search of fertile soils contributing to deforestation and land degradation. There is therefore the need to address this constraint with innovative land use technology that would sustain production in the face of this challenge. The specific objective of the trial was to verify and demonstrate improved agronomic package for sustainable yam production in two yam growing communities (Ejura and Atebubu) in the Transition part of Ghana. Two treatment packages of improved agronomic practices and farmers' practices were arranged in Randomized Complete Block Design on a total of 8 farmers' fields consisting of 4 each from Ejura and Atebubu. The improved agronomic package included; use of ridging as seedbed, seed treatment before planting, fertilizer application at a rate of 45:45:60 N: P_20_5: K_20 kg/ha and the use of minimum staking (trellis; 30-50% number of stakes used in farmers staking). This was compared with farmers' practice which consisted of mounding and no fertilizer application and no seed treatment. The results revealed significant difference ($P < 0.05$) in yam tuber yields of 196% and 205% on the improved agronomic fields over farmers' practice fields in Ejura and Atebubu farming communities respectively. Also a high benefit cost ratios of 8.09:1 and 7.47:1 were observed for improved agronomic practice over the farmer practice fields in Ejura and Atebubu respectively. The study had demonstrated that out-scaling of improved agronomic packages would sustain yam production on continuously cropped fields and address the problem of deforestation associated with yam production.

Keywords: Continuously cropped field; Deforestation; Farmers' practice; Fertilizer application

Increasing Farmers' Access to Conserved Yam Genetic Resources In Ghana

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A survey conducted previously in following yam growing communities: Dinkro/Mame Krobo (Afram Plains) – Eastern Region; Mfadwen/Bontrase - Central Region; Nyankumasi/Upper Manya Krobo - Eastern Region and Agoufie/Nkwanta - Volta region in 2012 involving scientists, farmers and Agricultural Extension agents revealed that, a greater proportion of yam genetic resources being conserved by farmers on-farm, are getting extinct as indicated by the four square analyses. Some of these yams collected are being conserved *ex-situ* in the gene bank at the CSIR-Plant Genetic Resources Research Institute. A strategy was formulated to increase farmers' access to these materials through regeneration, multiplication and distribution to farmers to augment their genetic stock. A total of 89 accessions of yams - *D. alata* (40 accessions); *D. rotundata* (42 accessions) and *D. esculenta* (7 accessions) were multiplied, using the mini-sett technique to produce in 1500 micro tubers. The planting materials were distributed to 30 farmers, 10 each in Mame Krobo, Mfadwen/Bontrase and Nyankumasi, to serve a primary multiplication and distribution site. In all, 330 farmers (110 farmers per community) received yam germplasm to replenish their genetic stock and thus broaden the genetic base of their materials on-farm, for conservation, sustainable food security and income generation.

Keywords: Conservation, Genetic resources, On-farm, planting materials, yam,

Seed Yam Generation: Low Cost but Efficient Techniques

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The low multiplication ratio of yams has been cited as a major constraint in expansion in yam production through its direct impact on availability and cost of seed yam. In recent times, new and improved systems for seed yam generation have been developed albeit complex and expensive. The study reports on cost effective and simplified methods for generating seed yams. The pros and cons of these methods are also analysed.

Keywords: seed, yam

Management of root-knot nematodes with *Trichoderma viride*s

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Root-knot nematodes (*Meloidogyne spp*.) are one of the most economically damaging agents on yam producing fields which could lead to 100 % yield loss. The use of biocontrol agent such as fungi is among the sustainable methods recommended to manage the menace of root-knot nematodes. The potential of three isolates of *Trichoderma viridesm* to reduce soil populations of *Meloidogyne spp*. was evaluated at three different yam producing locations in Ghana. *Trichoderma virides* was isolated from soil from the three locations (Atebubu A, Kintampo K and Wenchi W). The fields were naturally infested with nematodes and the population of *Meloidogyne species* in the soil was assessed before planting and after harvesting. Three white yam (*Dioscorea rotundata*) varieties *Pona, Dente* and *Afebetua* were used. Suspensions of *Trichoderma virides* at a concentration of1.7 x 10^7g/l isolated from the three locations were inoculated on the varietiesone month after planting. Analyzed results indicated that inoculation of *Trichoderma virides* resulted in significant reduction in *Meloidogyne* populations after harvesting in all the locations on all three yam varieties. At Atebubu all the three isolates (A, K, W) were able to reduce the *Meloidogyne* populations by 78.8%, 66.8% and 66.2% respectively on *Pona*. No nematodes were isolated from all the peels of inoculated tubers harvested.

Keywords: *Dioscorea rotundata*, *Meloidogyne* spp, Root-knot nematodes, *Trichoderma virides*

Influence of Fertilizer Application on Postharvest Storage of White Yam Tubers

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Yam growers across major growing areas are being encouraged to increase harvest yield through the application of fertilizer at the recommended rate and time. Ghana, which is the leading exporter of yam in the world is currently threatened by poor tuber storability .Large quantities of yam exported to the US from Ghana were rejected, with an estimated losses of 30-60% of sea and air-freight imports found to be unwholesome upon arrival in that country. Some actors along the food value chain attribute most storage rots to the application of fertilizer by farmers. This study was conducted to investigate into the claim that fertilizer application has effect on the shelf life of most white yams. Five fertilizer application levels, including a control (no fertilizer application) were tested on two white yam cultivars, *Serwa* and *TDr95/19177*. Healthy- looking white yam tubers were randomly selected from a fertilizer application trial in Ejura-Sekyeredumasi district and storage rot experiment set-up at CSIR-CRI (on- station). Initial parameters taken were tuber weight, yield and moisture content. Temperature and relative humidity were periodically recorded. Rot assessment were done at 3rd, 4th, 5^{th} and 6^{th} months of storage. Rot analysis parameters taken were tuber weight, number of rotten tubers, rotten tissue weight, rot initiation point, rot type and associated pathogens. Major fungi identified from rotten tissues over the period were: *Lasiodiplodia theobromae, Fusarium oxysporum, Penicillium sp., Rhizopus sp., Aspergillus flavus* etc. About 54% of rotten tubers were the dry rot type. There was apparently no significant difference in terms of rot incidence and severity among the fertilizer application levels as well as the control. However, varietal differences and tuber sizes were key factors identified as having effect on storage rots. Currently, other investigations are underway on some important white yam varieties like *Pona* and *Dente* to evaluate the influence of fertilizer application on their shelf life.

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Keywords: fertilizer application, storage rots, white yams and storability.

Value addition characteristics of water yam (*Dioscorea alata*) varieties marketed in the Ashanti Region of Ghana: prospects for expansion in utilization and trade

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A rapid assessment of major markets in the Ashanti Region was undertaken to ascertain the types of water yam (*D. alata*) varieties available. Three (3) main types were identified and market price per unit weight (kg) of tuber ranged from GHC0.85 – 1.45 for water yam compared to GHC1.87 – 4.23 for the popular *D. rotundata* varieties ('Pona' and 'Dente') which are premium yams for both local and export markets. Sensory evaluation in a blind-coded test for boiled yam gave higher acceptability ratings for 'Matches', the most predominant *D. alata* variety in the market, than 'Dente'. Profiling of product sensory attributes for fried crispy chips showed that while 'Pona' scored highest in appearance, all the *D. alata* varieties scored highest in taste/aroma as well as overall acceptability. This was due to the presence of bitter after-taste in fried crispy chips of the *D. rotundata* varieties. Ash contents of the yam varieties ranged from 1.70% – 2.84% and protein contents ranged from 3.77% – 5.88%. Protein correlated positively with aroma/flavor (r = 0.697) of the fried crispy chips while both ash and protein contents were found to correlate negatively with bitter after-taste (r = -0.552 and r = -0.505 respectively) in the chips. Results indicate immense potential of the *D. alata* varieties for profitable value addition due to low market price of the raw material and high acceptability of shelf-stable finished products. The potentials of various other innovative products developed from the *D. alata* varieties are discussed.

Keywords: Water yam (*Dioscorea alata*), sensory attributes, market price, innovative products, ash content, protein content

Gender Diversity in Soil Fertility Management for Yam Production in Ghana; The Case of Ejura Sekyeredumase District

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Low productivity in yam production has been attributed to the increasing declining of soil fertility. This has led to the promotion of various soil fertility management options. Understanding gender diversity in soil fertility management is crucial in mainstreaming gender into the dissemination and adoption of effective soil fertility management options. Gender diversity analysis was done using data generated from 100 yam farmers in the Ejura-Sekyeredumase district. The multi-stage sampling technique was used in generating data through face to face interviews using a standard questionnaire. Results showed that 83% of adult males preferred the use of manure while 43% of adult females preferred mulching to other soil fertility management options. In addition, 44% of the youth preferred the use of inorganic fertilizers. Males dominated in soil fertility management activities such that 80.6% and 95.7% of respondents indicated mobilising capital and implementation of options were carried out by males respectively. The role of women in decision making was limited. About 33% and 39% of women took an active part in deciding on the type of soil fertility management option and when to implement the option respectively. Women had a strong voice (81%) in deciding on how to spend the money from the farm.

Keywords: Decision Making Gender, Productivity Soil Fertility, Women

Growth and yield of tissue culture generated seed yams *(Dioscorea rotundata Poir)* on the field

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The use of healthy seed yams is essential for high and sustainable yam production and storability. Healthy and quality seed yam is however scarce as a results of the low propagation ratio of the crop. Yam farmers therefore resort to the use of pre-infected seed yam resulting in the production of small and poor quality ware yams. Tissue culture can be used to rapidly produce disease-free and high quality seed yam in large quantities. This study was conducted as a preliminary study in a forest agro ecological zone in Ghana to access the growth and yield of seed yams generated form tissue culture on the field. A total of 376 primary seed yams obtained from previously grown tissue culture derived seedlings yams from the CSIR- Crops Research Institute biotechnology laboratory were planted on ridges at a distance of 40 cm in between rows. The seed yams were sorted into 4 different groups based on their sizes with an average size of 0.12, 0.06, 0.02 and 0.01 kg for groups 1, 2, 3 and 4 respectively before planting. The number of sprout ranged from 0% at planting to 69, 71, 42 and 36% respectively for groups 1, 2, 3 and 4 at 92 days after planting. Group 2 had the highest germination percentage followed by 1, 3 and 4 respectively. The number of harvested tubers was 142which resulted in 13,027.52 plants/ha (plot area = 0.0109 ha). The total weight of the harvested tubers was 37.5 kg with an average weight of 0.26 kg. Group 2 also recorded the highest average weight of 1.65 followed by group 1 (1.56) with group 3 recording (1.55) and group 4 (0.81) respectively. The results suggested that tissue culture generated seed yams can perform adequately on the field with the appropriate agronomic practices and is a useful means to ensure reliable source of clean seed yam for enhanced yam production.

Keywords: Forest agroecological zone, seed yam, sustainable yam production, tissue culture,

Maximizing Natures Gain: The Yam-Legume Cropping System in Ghana

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Yam production in Ghana is mainly under rain-fed conditions. Sustainability of rain-fed yam production for small-holder farmers are however uncertain due to declining soil fertility, soil erosion and unpredictable rainfall. This has resulted in the quest for improved management strategies that can result in better use of available resources (e.g. selecting the appropriate crop and cropping system to match the total amount and pattern of seasonal rainfall for high yields). The objective therefore was to investigate the effect of yam-legume cropping systems (intercropping or not) and seedbed management (ridges or mounds) practices on maximizing productivity. Experiments were conducted on-station at Fumesua (Forest) in 2013 and 2015 cropping seasons and on-farm at Ejura, Hiawoanwu (Forest-savannah transition) of Ghana in 2015 season. *Dente* variety was planted in a split plot design in three replicates with seed bed preparation (ridges and mounds) as main plots, with cropping systems; sole yam, yam + cowpea, yam + groundnut as sub plots. The results indicate that *Dente* yields in 2013 were higher than that of 2015 due to the favourable rainfall pattern recorded in 2013. Land Equivalent Ratio's (LER) of 1.75 and 1.64 for 2013 and 2015 respectively denoted that yields obtained from intercropping yam with groundnut or cowpea were better than yields from sole cropping. Significant ($P<0.05$) interactions were observed between seed bed and cropping system for both on-farm and on-station experiments across seasons. In terms of tuber yields, yam-legumes on ridges or yam-legumes on mounds showed 12% yield increase on the average over sole cropping on ridges or mounds. Mean tuber yields of yam-legume intercrops on ridges were slightly higher (24.5:12.9 t/ha) compared to yam-legume intercrops on mounds (22.35: 9.5t/ha) and sole cropping (21:9.3 t/ha) for 2013 and 2015 seasons respectively. Yam-legume intercrop plots used water more efficiently (about 10% on the average) than sole plots mainly as a result of lower surface and subsurface evapotranspiration resulting from enhanced canopy spread. This work further elaborates on intercropping as a major cropping system option for maximizing productivity.

Keywords: Yam-Legume, Cropping system, Tillage, intercropping

Comparative Crop Water Assessment in a Yam/Legume Cropping System using the CROPWAT 8.0 Model

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Improving crop water use efficiency and water productivity has long since been an area most irrigators and researchers favour. In rain fed agriculture, enhancing water use efficiency ensures that yields are maintained or increased with the available/effective rainfall. Breeding for superior and drought resistant crop varieties can contribute greatly in enhancing crop water use efficiency. However, this takes time and most often than not, farmers do not get access to these new improved crop cultivars. Smallholder farmers therefore rely on on-farm best agronomic practices that would provide the most immediate and productive way to enhance water use. This paper examines the water use in a cereal-legume cropping system using one each of an agronomic and mechanical solution: intercropping and seed bed management. A field experiment was carried out at the CSIR-Crops Research Institute to determine the agronomic parameters needed by the model for simulating evapotranspiration. Single and dual crop coefficients were determined from the length of the growth stages. By inputting climatic, soil and crop data, daily evapotranspiration was determined using the CROPWAT 8.0 model. Employing a 0% yield reduction and an 80% effective rainfall, total evapotranspiration values exceeded total effective rainfall of the season for the sole yam treatment, suggesting insufficiency of the rains. Total evapotranspiration for the yam-legume (groundnut and cowpea) intercrops were 5% and 12 % respectively, lower than the sole yam suggesting that intercrops utilizes soil moisture more effectively than their corresponding sole crops.

Keywords: Water productivity, water use efficiency, evapotranspiration, soil moisture, simulation, crop coefficient

Advances in Yam Improvement: Relevance, Approaches and Strategies

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Yam is a highly economic crop for the smallholder farmer. Ghana is the lead exporter of yam making it a high value commercial root and tuber crop. However, farmers only achieve just about half of the potential yield of 22t/ha. Production largely depends on availability of quality seed, soil fertility and rainfall. Information on how to improve production, good agronomic practices and approaches to mitigate and adapt to the changing climate are still scanty. However, over the last decade, both international and local partners along the yam value chain, has made gains in yam improvement by increasing the yields of yam through various interventions resulting in increased yield per unit area, availability and access to healthy seeds, reduced yam disease and pest incidences and ensuring increased shelf life. This paper as a bundle of goods, summarizes various technologies, innovations, strategies and tools scientifically proven in a concerted fashion that increases yield levels to at least 40% over the current yield of just 11t/ha. These interventions include but not exclusive to; Integrated soil fertility management (achieving water use efficiency through intercropping, crop rotation etc.), multiple propagation of seed yam (in-vitro micro propagation-1:200, vine technology- 1:240, mini-sett technique-1:30, aeroponics-1:250, hydroponics-1:200, temporary immersion bioreactors systems, photoautotrophic culture). Others include the use of mechanized ridging (35-50% yield increase per unit area), seed treatment, minimum staking options (use of trellis for *D. rotundata*, no stakes for *D. alata*), seed sett sizes (150g-200g), integrated pest management (reducing early pests and diseases attack through combined practices, weeding at least 3 times in a season) and postharvest storage mechanism (practices that promote ventilation and tuber protection). These interventions (which are continuous and unending) highlights the potential of research to boost yam production and food security and are thus worth reviewing.

Keywords: Agronomic strategies, Intensification, Seed Multiplication, Productivity, Potential yield

InVitro Performance of Some Selected Improved and Farmers Varieties of Yam *(Dioscorea spp)*

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Yams are cultivated worldwide especially in West Africa and South Eastern Asia. Approximately 95% of the world's annual production comes from West Africa. Ghana is the leading exporter of yams in the world even though it is the third producer behind Nigeria and Cote d'Ivoire. Apart from the export market there is also domestic use for the crop as well. Yams form the majority of calorie intake in most Ghanaian households.The availabilityofseedyamisimportantfortheyamindustry as it forms 70% of production cost. However, different yam varieties in Ghana differing physiological characteristics when grown under the same conditions *invivo*, it is expected that *invitro* performance will also differ under the same conditions. Improved varieties especially have not been disseminated and also the landraces needs to be improved for use. This study evaluated the *invitro* performance of two released (*CRI-Pona, Mankrong Pona*) and four land races (*Dente, Pona, Labariko, Matches*). Minisetts were obtained from CSIR-CRI breeding program and established in screen house as the source of mother plant for *invitro* manipulations. Explants from axillary buds and meristem shoot tips were initiated *invitro* using Murashige and Skoog's (MS) medium supplemented with BAP, NAA, and other additives. Successfully initiated and established cultures were sub-cultured onto MS multiplication media supplemented with kinetin, and AdSO4.Growth parameters taken included number of days to sprouting, number of shoots, leaves, and root development. Results obtained showed that the improved varieties have a greater performance than the landraces. Comparatively *M. Pona* performed better than *CRI-Pona*. Again, they performed better than the landraces probably because they are *D. alata* varieties followed by *Labariko* and *Dente*. Data obtained provided maximum information on the *in vitro* characteristics of different yam varieties. Various varieties performed differently on the same growth conditions provided and this could probably be due to differences in their genetic makeup.

Keywords: Establishment, Initiation, Kinetin, Multiplication, Murashige and Skoog

Demystifying Aeroponics: The Gravity-Fed Option for Seed Yam Propagation

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Aeroponics has been perceived as a technology packed innovation, far out of reach to the ordinary farmer. Apart from its continuous dependency on electrical power, the technology comes with very sophisticated inputs such as solenoid valves, timers, misters, CO_2 tanks, and air and water pumps. To maintain the ideal nutrient concentrations, thermometers, hygrometers, electrical conductivity and pH meters are also needed. The main objective of this study was to evaluate the option of using gravity-fed aeroponics system for propagating seed yams from vine cuttings. The study was setup at the CSIR – Crops Research Institute in conjunction with the Agricultural Engineering Department of the Kwame Nkrumah University of Science and Technology. The basic advantage of this system is its non-dependency on electrical power, pumps or timers and its ability for continuous production. The system was set-up used conventional materials and equipment available on the local market. The treatments were arranged in a split-plot design with four nutrient concentrations (C1 - , C2 - , C3 - and C4 -) and vines of three *Dioscorea rotundata* varieties (*Dente, Pona and Mankrong Pona*) as main plot and sub-plot treatments respectively. Results showed there were significant differences (P<0.05).

Keywords: conventional materials, nutrient concentrations, vine cuttings, propagation

Genotyping of released and elite yam varieties using Simple Sequence Repeats (SSRs)

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Yam (*Dioscorea spp*.) is a very important staple crop in Africa, and its demand for local consumption and export has increased tremendously in recent years. The Yam Breeding Program at the CSIR-Crops Research Institute in 2005 released three yam varieties. These released varieties as well as that of important farmer preferred varieties have to be documented for the purpose of traceability and future breeding effort. The focus of this study was to genotype released and elite yam varieties. This was done by using a set of SSR (Simple Sequence Repeats) markers. SSRs are a useful tool for genotyping due to their high polymorphic information content (PIC), co-dominant inheritance, locus specificity and its extensive genomic coverage. Sixteen microsatellites SSR markers were used to screen the three released varieties (*CRI-Pona, CRI-Kukrupa, and Mankrong Pona)* and seven elite lines (*Labreko, Muchumudu, Pona, Labako, Kpuno and Kperingo Dente)* which were collected from the tissue culture laboratory of CSIR-CRI. Amplicons generated from PCR products were manually scored as present or absent. Scored data was analyzed using various softwares to facilitate the validation of the selected set of primers as well as justify the need to develop primers for genotypes endemic to West African Sub-region. Results of the study did indicate that the 20 microsatellites SSR markers used to screen the released Yam varieties has made Yam fingerprint information available to monitor the integrity of the released varieties. Analysis with DARWIN revealed three clusters where *CRI Pona, CRI-Kukrupa, Dente and Labreko* were grouped in one cluster. *Mankrong Pona and Muchumudu* was also grouped together. Similarly matrix generated confirmed the clustering. This set of data has been documented for use in the sub region.

Keywords: Amplicons, Fingerprint, Microsatellite, PCR, PIC, SSRs

COCOYAM TECHNICAL SESSION

Cocoyam Value Chain Research and Development in the ECOWAS Sub-Region

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Two edible aroid species (*Colocasiaesculenta* and *Xanthosoma*spp) commonly referred to as Cocoyam in the West African sub-region are well adapted, widely cultivated, and consumed in many ECOWAS countries particularly by the low income earners. Although over 60% of cocoyam global production occurs in the ECOWAS sub-region and they ranked high in importance among root and tuber crops in many countries, they have not received commensurate research and development attention when compared to other root and tuber crops. Consequently, they are under exploited and their potential contribution to improvement of livelihood and economic empowerment of its growersremains largely unrealized. Considering cocoyam value chain from the perspective of farm-to-folk, key challenges in different stages of the value chain were identified. Critical among these are diverseproduction constraints such as recent outbreak of Taro leaf blight (TLB) disease in many countries with associated economic loss to the region conservatively put at over 1.4 billion US dollars annually. Another critical constraint in the value chain is the poor market integration system for cocoyam.Research opportunities that could mitigate these constraints and unleash the untapped potential of cocoyam for food security, income generation and economic empowerment in the region were identified. The need to give attention to basic, applied as well as developmental research, and roles of various stakeholders were highlighted. The need for public and private support for cocoyam development was also highlighted with the conclusion that NARs in ECOWAS countries should champion the course of mobilizing resources for research and development of cocoyam if these species are to take their appropriate place in agricultural development of the sub-region.

Keywords: Cocoyam, Constraints, Development, ECOWAS, Research, Value-chain

Progress in Taro (*Colocasia esculenta (L.) Schott*) Improvement in Ghana

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This paper presents progress made in taro improvement in Ghana under the project " *Adapting clonally propagated crops to climate and commercial change"* funded by the European Union (EU) and co-ordinated by the International Network for Edible Aroids (INEA). Activities carried out were: collection of germplasm (introductions and local materials), characterization (agro-morphological, molecular and nutrient quality), on-farm participatory varietal evaluation and selection and hybridization. Fifty accession of taro received from South Pacific Centre (SPC), Fiji and 82 accessions collected from Ghana were evaluated in the field using International Plant Genetic Resources Institute (IPGRI) descriptors. A participatory rural appraisal was conducted in two taro growing areas (Ejisu-Juaben in the Ashanti Region and Atiwa District in the Eastern Region) to elicit information from farmers on: history, agronomy, cultivars, uses, diseases and pests as well as challenges facing the farmers. Leaf and corm samples were prepared and sent to, Montpellier, France and Maribor, Slovenia for molecular and nutrient analysis respectively. On- farm participatory varietal selection was conducted with 50 participants to select desirable agro-morphological traits and culinary properties of the taro germplasm. A breeding programme was initiated. Results showed that major production constraints were high cost of production and lack of planting materials. A dendogram of the local accessions revealed that there is lack of variability in the local germplasm. Most of the exotic accessions flowered, had high yields and tolerant to the taro leaf blight (TLB) disease as compared to rare flowering, low yields and susceptible to TLB in the local accessions. Significant differences were observed in the traits evaluated on-farm. Promising accessions in terms of aroma, colour, taste and texture, have been selected. Out of 280 crosses made, 32 (representing 14%) set seeds, which have been collected and nursed for evaluation. The on-farm evaluation has exposed the farmers to new germplasm. The successful hybridization will increase the genetic base for the advancement of taro improvement in Ghana.

Key words: Breeding, Characterization, *Colocasia esculenta*, Participatory rural appraisal, Participatory varietal selection, Taro improvement

On-Farm Evaluation and Farmer Participatory Varietal Selection of Taro (*Colocasia esculenta*) In Ghana

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Taro *(Colocasia esculenta*) is one of the underutilized edible aroids in Ghana but has great potential as a food security crop. It is highly adaptable to diverse environmental conditions. Some introduced and local accessions were characterized under field conditions at Nobewam in the Ejisu-Juaben Municipality of the Ashanti Region in 2011. Thirty promising accessions were selected based on yield and tolerance to Taro leaf blight (TLB) for on farm evaluation at six locations with the participation of 40 farmers. At the peak vegetative stage and at harvest, the accessions were assessed with farmers based on their agro-morphological characteristics, yields and organoleptic properties. Results showed that across the locations, the ranges of the traits evaluated were as follows: Plant height - 20.8cm to103.4cm; number of leaves - 2.2 to 6.9; plant spread - 25.7cm to 194.3cm; number of suckers - 0.3 to 23.9; percent infection by taro leaf blight (TLB) - zero to hundred percent (0 to 100%) and corm yield perplant-130g to1033g. Statistical differences were observed among the accessions the traits evaluated. Majority of the farmers selected plants with the following characteristics: many leaves (68%), many suckers (80%), taller plant height (60%), early maturity (80%), bigger and cylindrical corm size (84%). In terms of the combination of the organoleptic properties (taste, colour, aroma and texture), 22 accessions were evaluated as follows: nine accessions were classified as excellent; five as very good; three as good and five as poor. The selection and incorporation of desirable agro-morphological traits, yield and tolerance to TLB in a participatory manner will lead to the development of taro varieties with acceptable characteristics to users.

Key words: *Colocasia esculenta*, Farmer participatory selection, On-farm evaluation, Taro

Preliminary Studies on the Development of Simple Sequence Repeats (SSRs) Markers for Cocoyam

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Xanthosoma sagittifolium (L.) commonly called cocoyam is a less scientifically studied root crop especially at the molecular and cytogenetic levels. Recent increased knowledge in molecular genetics has facilitated the characterization of a number of molecular events in root and tuber crops such as sweet potato, cassava and yam. Hence the need to explore the genome of cocoyam in order to create an efficient marker system for the study of its genetic relationship and improvement cannot be overemphasized. This study seeks to develop SSR markers which could be utilized for the characterization of cocoyam germplasm. Ten morphologically diverse cocoyam lines (based on flesh colour) assembled from CSIR-Plant Genetic Resources Research Institute were used for the study. Development of the SSR markers was initiated with the creation of DNA libraries from the assembled cocoyam DNA's samples. DNA libraries created were enriched followed by library cloning and screening culture and minipreps and subsequently they were sequenced of which 21 SSR markers were designed. These markers were synthesized and tested for polymorphism out of which 20 of them showed polymorphism. These markers have also shown to be specific to only cocoyam when validated with other root and tuber crops.

Keywords: Genetics, Markers, Molecular, Polymorphism, SSRs

Review of Information on Genetic Resources Activities of Some Root and Tuber Crops in Ghana

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Plant genetic resources (PGR) are those resources that are of benefit to man. They are plant materials containing useful characters of actual or potential values. Genetic resources information on acquisition, characterization, evaluation, documentation and distribution of six root and tuber crops under conservation at the Council for Scientific and Industrial Research-Plant Genetic Resources Research Institute (PGRRI), Bunso, were reviewed as a genetic resources support component for effective management of the germplasm for crop improvement. This paper investigates six root and tuber crops; yam, cocoyam. taro, sweetpotato, frafra potato and cassava, germplasm collection mission, sponsors, species collected, conserved and distributed to farmers. Detail acquisition information on germplasm which include geographical location, edaphic and climatic factors, ethno-botany, and agronomy were reviewed The six root and tuber crops had characterization and preliminary evaluation information on phyllotaxy, twining habit and direction, density of spines on vines, plant hairiness, plant pigmentation, mature leaf length/breadth ratio and lamina/petiole length ratio. Germplasm with the maximum and minimum parameters were indicated. The root and tuber crops are being conserved in the field genebank and at the plant tissue culture facility. The germplasm are maintained through periodic regeneration. Materials are distributed to farmers and other stakeholders upon request. Materials mostly collected, conserved and distributed were yams while the least was sweetpotato. The implications of the information on effective conservation and use of the six root and tuber crops are discussed. The study recommended adequate information on roots and tubers genetic resource for crop improvement.

Keywords: Characterization, Conservation, Genetic Resources Information, Review, Root and Tuber Crops

In Vitro Production of Clean Planting Material: Setting the Time Lines

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In vitro propagationprovides the required micro-climate critical for growth and development of plants; and is used to rapidly propagate vegetatively propagated cropssuch as Yam, Cassava, Cocoyam, Taro and Sweetpotato. Conventional vegetative propagation, however, has limitations when large numbers of clean disease free planting materials are required. This is because vegetative propagules usually habour disease pathogens namely fungi, bacteria, and, viruses in the planting material, and the multiplication rates are low, unlike in grains and cereals. Meristem culture *in vitro* techniques coupled with thermotherapy, chemotherapy and cryotherapy, are techniques routinely used to eliminate such pathogens from plant tissues. This results in the production of clean disease – free planting materials. This study used meristem and thermotheraphy systems where applicable to produce clean planting materials of sweetpotato, cassava and yam. Molecular and ELISA assay based methods were used toIndex cleaned cultures, to certify that the germplasm is clean. Results from this study have indicated that it takes up to 12, 18, and 24 months to generate clean planting materials of Cassava, Sweetpotato, and Yam respectively. Similar systems are being investigated for Taro and cocoyam and preliminary results indicate it take up to 6 months to generate clean planting material. This paper reports the detailed time lines in the production of clean planting material using tissue culture techniques.Information is very paramount for a sustainable pre-based seed production of planting material of root and tuber crops.

Keywords: Indexing, Meristem, Regeneration, Tissue Cultures, Thermotherapy,

Enhancing Germplasm for Resistance to *Phytophthora* Leaf Blight Disease in Taro (*Colocasia esculenta (L.) Schott*)

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Taro (*Colocasia esculenta*) is an important food crop cultivated for its edible corms and leaves in Ghana. Its carbohydrate structure is not complex and therefore takes short time to cook when boiled and the leaves are frequently eaten as a vegetable and represent an important food security crop. Serious outbreaks of *Phytophthora* leaf blight disease caused by oomycete *Phytophthora colocasiae* have threatened sustainable taro cultivation. The disease defoliates and causes death of plants and thus impacts negatively on livelihoods and food security of small farmers and rural communities dependent on the crop. The objective of this study was to evaluate the local and introduced germplasm of taro in Ghana for resistance to the disease. Thirty five accessions of taro made up of local and exotic germplasm were inoculated with three isolates of *Phytophthora colocasiae* using completely randomized design with five replications. There were significant differences ($p < 0.05$) among the accessions for foliar resistance to the three isolates of *Phytophthora colocasiae*. Genotype isolate interaction was not significant suggesting that resistance to leaf blight disease in taro is not *Phytophthora colocasiae* isolate specific. This indicates that a genotype selected for resistance to one isolate could be resistant to all other isolates of *Phytophthora colocasiae*. The ratings of the disease categorized the thirty five accessions evaluated into susceptible, moderately susceptible and resistant genotypes. Both local and introduced accessions that were resistant to the disease were used to form the base population for development of hybrids of taro with enhanced resistance to leaf blight disease.

Key words: *Colocasia esculenta*, Germplasm, Ghana, leaf blight disease, *Phytophthora colocasiae*, resistance, Taro

Variations in Pathogenicity of *Phytophthora Colocasiae* Isolates from Selected Taro (*Colocasia esculenta*) Fields

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Fifteen isolates of *Phytophthora colocasiae* Racib, collected from naturally infected taro, *Colocasia esculenta* (L.) Schott, fields from the Ashanti region of Ghana were assessed for their differences in pathogenicity based on various aggressive components such as infection efficiency (IE), incubation period (IP), lesion size (LS), latent period (LP) and sporulation capacity (SC) after their inoculation onto detached leaflets of taro. Significant differences ($P < 0.05$) were observed among the isolates based on the aggressiveness components (IE, IP, LS, LP and SC) studied except infection efficiency. The study indicated that the isolates were diverse based on their aggressiveness potentials as measured by the epidemiological components.The isolates were therefore classified as weak, moderate or highly aggressive.

Keywords: Aggressiveness, Detached-leaf, *Phytophthora colocasiae*, Leaf blight, Taro

Effect of Fertilizer Application and Plant Density on Yield and Growth of Taro

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Taro (*Colocasia esculenta* (L.) Schott) is an ancient crop grown throughout the sub- region for its edible corms and leaves, as well as other traditional uses. It occupies a significant place in the agriculture of Ghana and its underground root, known as corm, possesses a high nutritional value. Hitherto information on nutrient requirements of Taro was scarce on upland farming systems in Ghana. Yields are generally low and a simple technology such as fertilizer application and improving planting materials or increasing plant population is deemed an option to increase root crop production. However, to minimize plant competition, improving plant population should be followed by plant arrangement. The effects of inorganic N and organic fertilizers on upland taro were quantified with the aim to determine the correct soil nutrient levels for optimal growth and increased productivity. The field experiments were carried out at Fumesua, Mankranso and Bekwai of Ghana. The experimental treatments for plant density consisted of four plant densities (10,000, 16,666, 18518 and 40,000/ha). Four levels of fertilizer combinations: 30:30:30 (KgN: P_2O_2: K_2O/ha), 4t/ha of organic manure, 2t/ha (200g/plant+15:15:15 (KgN: P_2O_2: K_2O/ha) and zero/control were given in split applications. The F-value ($p = 0.05$) was used to test the treatment effect and Least Significant Different (LSD) ($p = 0.05$) was used to test the difference between treatments. The results showed significant differences between fertilization and plant density for most of the parameters. Number of tubers/plant, tuber weight/plant and tuber yield/ha were significantly influenced by fertilizer application. The yield of non- marketable taro corms was not affected by N fertilizer but marketable corm yield doubled at high N fertilizer rates. Combined applications of organic and inorganic fertilizers yielded 6–7t/ha corm yield. With plant spacing of: 50×50, 60x100, 60x90 and 100×100 cm, increasing plant population from 10,000 plants/ha (plant spacing of 100×100 cm) to 40,000 plants/ha (plant spacing of 50×50 cm) resulted in an increase in plant population and disease severity at harvest. The mean percent infection was higher on fields at Mankranso (96.5) than in Bekwai (82.6) with mean severity scores of 2.6 and 2.8 respectively. Total tuber yield decreased at higher plant density (40,000 plants/ha). Spacing had a highly significant ($p<0.005$) effect on marketable and unmarketable tuber yields per hectare.

Keywords: fertilizer application, plant density, Taro, organic manure.

Sustainable Soil and Crop Management Strategies for Increased Cocoyam Production in Ghana

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Soil fertility decline is a major constraint to cocoyam production in the growing areas of Ghana. Fertilization should be employed, either to obtain high yield or to maintain soil productivity. However, the high cost of inorganic fertilizers makes it an unrealistic option for resource poor farmers in the cocoyam producing areas. Early maturing cocoyam varieties also tend to sprout resulting in poor quality cormels for sale at harvest, justifying the need to determine the appropriate time for harvesting early maturing varieties of cocoyam. This study addresses the challenges associated with declining cocoyam production through a sustainable soil and crop management strategies in three cocoyam growing areas. A laboratory study was carried out to investigate the nutrient potential of poultry manure as locally available material. The field experiment was carried out to assess the effect of organic and inorganic fertilizers application and the appropriate time for harvesting early maturing varieties on growth and yield of improved cocoyam variety "Gye me di". The first experiment consisted of five rates of inorganic and organic fertilizer combinations (T_1: No fertilizer application; T_2: 30-30-30kg N-P_2O_5-K_2O/ha; T_3: 45-45-45kg N-P_2O_5-K_2O/ha; T_4: 4.0 t/ha Poultry manure; T_5: 2.0 t/ha Poultry manure+ 15-15-15kg N-P_2O_5-K_2O/ha). The addition of soil nutrient amendments generally increased cormel yields of "Gye me di" by about 104% at Fumesua as against 57% at Asesewa and 22% at Bechem in 2014. The increases in cormel yield following the addition of combined organic and inorganic fertilizer were 31%, 48% and 113% in 2014 at Kukuom, Assin Fosu and Fumesua respectively. Fertilization generally increased shoot yield expressed as plant height and leaf number. Leaf number increased with time to 5 leaves per plant and tend to reduce after 24WAP for the early bulking variety –"Ma ye yie" (white). A second field trial was conducted to evaluate the response of early maturing white cocoyam variety to different times of harvesting. The experiment consisted of four different harvesting dates; 8months after planting (MAP), 10MAP, 12MAP, 14MAP. Average cormel yields were significantly different at harvest dates. Mean cormel yields recorded ranged from 4.7 t/ha to 8.1t/ha, 4.2 t/ha to 6.7 t/ha and 6.5 t/ha to 8.3 t/ha at Fumesua, Bechem and Asesewa respectively

Keywords: Cocoyam, soil and crop management, fertilization

Supply chain analysis of cocoyam in Ghana

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Cocoyam is one of the most important food crops that is contributing to the incomes and food security of most Ghanaians. However, there is co-existence of weakly connected commodity chain that poses challenges to the distribution and marketing of the crop in Ghana and thus affecting incomes of chain members. Through formal and informal surveys cocoyam chain members were interviewed in order to identify challenges, barriers and opportunities and the way forward to develop and expand production and marketing of cocoyam. Results revealed that production of the crop was dwindling. Farm sizes were small varying from 0.2ha to 0.5ha.Cocoyam productivity remained low, with yields averaging 6tons/ha and lower in farmers' fields. Demand for cocoyam was all year round. Positive margins were recouped by all the actors along the cocoyam supply chain with farmers enjoying the most net margins in all the regions. The analysis also revealed the existence of both horizontal and vertical linkages among chain level members and along the value chain. These relationships could be strengthened to improve the constraints: improvements in storage system, improvement in the transportation system, improvement in the use of market information, increased use of improved technologies, increased marketing skills, improvement in product development.

Keywords: Cocoyam, development, supply, vertical-linkage

Developing Low Technology for Rapid Multiplication of Taro (*Colocassia esculenta (L) Schott)* Planting Material

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Taro (*Colocassia esculenta (L) Schott)* is normally propagated vegetatively using different parts of the crop. These are suckers, which sprout when a new farm is cleared and the corms which are of economic importance. This results in low multiplication ratio which reduces yield and crop quality favouring the accumulation of pest and pathogens. Availability of good planting material is also essential to sustained high production of cocoyam (Taro) in Ghana. Demand for good planting materials would be heightened by the release of new cocoyam varieties; and this thus makes such study very significant. This paper presents the preliminary observations on the development of a workable system to make quality and healthy planting materials available to farmers and researchers. It describes a protocol developed for the rapid multiplication of taro and establishes the fact that some parts of the crop taro will sprout spontaneously and grow well in certain growth media. A multiplication ratio of 6 to 10 per corm has been established. Sprout counts from the river sand (1237) were higher than that from the sawdust (1170). Seedlings from these growth chambers were healthy looking. And these seedlings when established in the field were able to withstand an attack by the Taro leaf blight disease (incidence-82%, severity-2.6), recording yields ranging from 7.5 to 12.3t/ha when compared with yields from a mix of locals (5.5 – 7t/ha). So far the study have supported the notion that nutritional predisposition of the planting material influence low or high yield. Supplementary nutrients will have to be applied to plantlets to boast its growth at the nursery stage.

Keywords: *Colocasssia esculenta,* planting material, rapid multiplication, multiplication ratio

Agro-Morphological Characterisation of Some Taro (*Colocasia esculenta* (L.) Schott.) Germplasm

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Taro *Colocasia esculenta* (L.) Schott.) is one of the underutilized crops in Ghana which has great potential in terms of food and nutritional security. Eighteen (18) accessions collected from Samoa (8), Malaysia (2) Indonesia (2) and Ghana (6) were studied under field conditions to collect information on their agro-morphological characteristics and yield potential for the development of the crop. The study was conducted at Nobewam in the Ejisu-Juaben Municipality in the Ashanti Region. Data were collected on 16 qualitative and 13 quantitative traits. Variations were observed in the vegetative and yield characteristics. Plant height ranged from 66.1cm -110.4cm; corm length ranged from 12.5cm -18.5cm; the maturity period ranged from 7-9 months and the corm weight ranged from 0.26kg–0.79kg. Significant differences ($p<0.05$) were observed in the morphological traits, indicating high degree of variability in the accessions. Among the morphological traits significant ($p<0.001$) and positive correlation was observed between corm length and corm diameter, between economic yield and the following: biological yield, corm diameter, length and corm weight. Leaf length correlated positively to corm diameter and corm weight. The Principal Component Analysis (PCA) showed that the first component (PC1) accounted for 53.98% of the morphological traits. Nine accessions: *CE/MAL/32, BL/SM/158, BL/SM/10, BL/SM/116, CE/IND/16, BL/SM/132, BL/SM/16, CE/MAL/14* and *SAO/006* possess desirable characters such as earliness and yield which could be exploited for varietal development of taro in Ghana.

Keywords: Characterization, *Colocasia esculenta*, Morpho-agronomic traits, Principal component analysis, Taro

On-Farm Evaluation of Five Taro Lines towards Increased Food Security in Ghana

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Taro [*Colocasia esculenta* (L.) Schott] is the fifth most important root cropconsumed worldwide.Its production in Ghana over the years has been bedeviled by taro leaf blight disease. There is the need for improved taro cultivars that are tolerant to the taro leaf blight to avert the negative impact the disease has had on the taro industry in Ghana. Five introduced taro lines (CE/IND 12, BL/SM 158, BL/SM 151, BL/SM 115 and BL/SM 16) from international network of edible aroids (INEA) were evaluated at Bipoa and Abrakaso all in the forest ecozone of Ghana alongside farmer's variety. Data were collected on corm yield, corm length, corm diameter, corm dry matter and harvest index. Sensory evaluation was done at harvest. The agronomic data were subjected to Analysis of Variance using Genstat Release 12.1 in a randomized complete block design. The data on the sensory evaluation were presented graphically. Genotype x location interaction was significant for all the traits. Significant genotypic differences were observed for the traits. Corm yield ranged from 2.25 t/ha to 5.86 t/ha. All the lines had significantly higher corm yield than the local variety except CE/IND 12. Corm length ranged from 13.67 cm to 16.61cm. Corm diameter ranged from 10.81cm to 15.20cm. Harvest index ranged from 0.45 to 0.69. Corm dry matter content was significantly higher for the local variety than all the lines. However, three of the lines (BL/SM 157, BL/SM 115 and BL/SM 16) had appreciable dry matter content. In all, CE/IND 12 performed poorly in comparison with the local variety among the five introduced lines. Three lines (BL/SM 157, BL/SM 115 and BL/SM 16) had relatively higher dry matter content. These lines will meet the food needs of farmers and consumers and therefore, needs to be selected for further testing in multilocational trials for subsequent release to farmers.

Keywords: Corm dry matter, Corm yield, On-farm, Taro, Taro leaf blight

Collection and Conservation of Root and Tuber Crops in Ghana

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Root and tuber crops are the most important food crops for direct human consumption in Africa. Adaptability to various agro-ecologies, high yield per unit area of land and nutritional quality make themchoice crops for food security programmes in Africa. Collection and conservation ofroot and tuber cropgenetic resource areimportant exercisesthat safeguard their genetic diversity for future and crop improvement purposes. The Plant Genetic Resources Research Institute (PGRRI) has been involved in the conservation of root and tuber crops in Ghana. This paper aims to highlight strides made by the PGRRI in the collection andconservation of root and tuber crops in Ghana.Root and tuber crops genetic resource collection in PGRRI dates back to 1965.Between 1965 and 2015, 2497 accessions of root and tuber crops were collected throughout Ghana and documented.Most of the root and tuber crops assembled were collected within Ashanti, Brong Ahafo and the Eastern regions of Ghana.Germplasm of the following crops namely yam, cassava, taro, cocoyam, sweetpotato and Frafra potato were collected.Cultivatable samples were collected from farms, markets, barns and the wild. Samples were multiplied on-station to acquire adequate quantities for conservation. Yam was the mostcollected root and tuber crop in Ghana. Seven (7) yam species were collected and constituted52% of the total germplasm collected within the period. Root and tuber crops are conserved as life plants *ex-situ* in the field genebank and duplicatesare kept under*in-vitro* conservation using plant tissue culture techniques at PGRRI. Research activities undertaken on the root and tuber genetic resources includes; agro-morphological characterization and evaluation against biotic and abiotic agents.

Keywords: Collecting, Conservation, Root and Tuber Crops, Genetic Resources, Accession

SWEETPOTATO TECHNICAL SESSION

Sweetpotato Value Chain Research and Development in the Sub-Region

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Sweetpotato has a huge potential as a source of income, food security, nutrition and feed to smallholder farmers and many households in West Africa, a potential which has not been fully exploited. A value chain approach means more than looking at markets. It includes changes in seed and production systems to improve the value added in market, implying strong linkages with crop management and field and off-field post-harvest handling. The quality of sweetpotato roots is often a key factor determining its entry into urban markets and root quality starts with appropriate varietal selection and crop management techniques. Three potential product value chains worth developing can be identified in West Africa among different types of producers: - the fresh root value chain, processed roots value chain and sweetpotato as livestock feed value chain. In sweetpotato value chain studies conducted in three West Africa countires – Ghana, Nigeria and Burkina Faso, three types of sweetpotato producers were identified: - (i) farmers who specialize in sweetpotato production as the most important cash crop for their farm; (ii) farmers who grow the crop as one of the cash crops, where sweetpotato may rank as second or third among these cash crops; and (iii) farmers who grow it mainly for home consumption, though still sell a part because the roots perish. The fresh and processed roots value chains are well suited for all the three types of farmers, while the sweetpotato as livestock feed value chain is best suited for the farmers who produce it as the most important cash crop and also appropriate for those grow it as one of the cash crops. In all these value chains, the potential interventions for improving the value chain system include: - breeding or selection of high-yielding varieties tolerant to biotic and abiotic stresses with characteristics acceptable to the market; a strong seed system to provided adequate quantities of quality planting materials; adopting best crop production technologies to reduce labour inputs, appropriate fertilizer application, best intercropping and rotation practices, best harvesting and post-harvest handling practices, organizing farmers to connect to national collectors to reduce costs and time spent on individual market efforts, and a better developed livestock system.

Evaluation of Six Sweetpotato Genotypes for Enhanced Food Security in Ghana

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Sweetpotato is a nutritious staple and food security crop in Sub-Saharan as well as providing employment and income for most rural households. The crop grows well on permeable and fertile sandy loam soil under an evenly distributed rainfall ranging between 750 mm and 1250 mm. One of the major challenges to Sweetpotato production in recent times is erratic rainfall, which can have devastating effects on the crop's biological performance in terms of yield and resistance to pests and diseases. To address these emerging challenges, superior sweetpotato genotypes need to be identified and developed to sustainably secure the livelihoods of most rural sweetpotato growing families. Six sweetpotato genotypes (*440390, 442162, Jitihada, BUN 5, NKO 31A, AP / 3A and Blueblue*) were evaluated in different agro-ecological zones of Ghana alongside three released varieties to assess their agronomic performance and adaptability. The released varieties (standards) were *CRI-Ogyefo, CRI-Apomuden and CRI-Sauti.* The trials were planted using Randomized Complete Block Design with three replications. Genotype x environment interactions (G x E) were significant *($p \leq 0.05$)* for root yield, vine yield, storage root dry matter content, virus and weevil tolerance. Root yield ranged from 14.6 –25.7 t/ha. Storage root dry matter content ranged from 28.1-38.6 %, vine yield ranged from 22.3 -31.7 t/ha, virus score ranged from 2.5 – 4.7 and weevil score ranged from 2.1-3.3. Five genotypes (*442162, NKO 31A, AP/ 3A, Jitihada and 440390*) showed comparable superior performance as the released varieties (standards). The presence of significant G x E indicates that multi-locational On-farm testing of these genotypes needs to be carried out before recommendation is made for their possible release as varieties to farmers.

Keywords: Food security, Genotype, Genotype X Environment Interaction (GXE), Livelihood, Multi- locational

The sweetpotato support platform for West Africa: Complementary efforts by the International Potato Center to strengthen sweetpotato breeding in West Africa.

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The International Potato Center (CIP) with headquarters in Lima, Peru, maintains the global sweetpotato germplasm collection and conducts sweetpotato breeding through a collaborative effort under the auspices of CGIAR program for Roots, Tubers and Bananas, which it coordinates. CIP has been conducting and supporting sweetpotato improvement efforts in Sub-Saharan Africa since 1988 through germplasm distribution and collaborative breeding and capacity strengthening efforts, working most strongly in eastern and southern Africa, and with limited engagement in West Africa. CSIR-Crops Research Institute, the WAAPP-mandated Centre of Specialization for root crops has a strong track record of sweetpotato improvement, including release of 12 varieties since 1998. CSIR-CRI and Ghana, were thus logical strategic partners for the establishment of a Sweetpotato Support Platform for West Africa under the CIP-led Sweetpotato Action for Security and Health in Africa (SASHA) project in 2009. At that time, CIP posted a sweetpotato breeder to CSIR-CRI to work with the sweetpotato breeding program in Ghana, emphasizing the development of less sweet quality types suitable for staple use and in processed products. This involved collaborative strengthening of a full breeding program, including the installation of analytical laboratory capacity (NIRS) for rapid quality analysis, participatory variety selection and release, germplasm clean up for regional distribution, and seed system strengthening in the context of nutrition value chains. The facilities of the program have served national and regional graduate students in plant breeding and provided virus-testing of advanced and released varieties from Ghana, Nigeria and Burkina Faso. The program has recently strengthened on the upstream end with the addition of the "Genomic Tools for Sweetpotato Improvement" project and on the seed system and markets side with the "Jumpstarting Orange Fleshed Sweetpotato through Diversified Markets" project. A multi-stakeholder Ghana sweetpotato innovation platform was recently established to ensure that sweetpotato breeding work, linked to seed systems and end use is demand-led and serving the needs of emerging value chains.

Keywords: Breeding, germplasm, participatory variety selection, sweetpotato,

Orange-Fleshed Sweet Potato: A Potential Source of Antioxidants and Provitamins for the Fortification of Infant Flour

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Containing carotenoids provitamins A, Orange-fleshed sweet potato (OFSP) flour which microbiological parameters were monitored, has been used to enrich infant flour, the misola. The new biofortified formulation of flour obtained presented nutritional qualities which contribute to protein-energy recovery and improvement of the immune status of moderate malnourished children. Indeed, by coupling chromatographic and spectral methods, β-carotene, α-cryptoxanthin, β-cryptoxanthin, lutein and zeaxanthin have been identified in extracts of Orange-fleshed sweet potato flour (Moumouni Koala et al.). Results obtained indicated that an enrichment of 30% of the misola with OFSP flour causes relative optimal increases in the levels of carotenoids (3271%) and total antioxidants (109%) compared to the pure misola. On the other hand, total polyphenolics content was not relatively affected (only 11% relative increases) by the additions of OFSP flour. Regarding intakes of energy values, M7J3 was found to represent the best formulation (802,56 kcal/ 200g); either relative increases of about 5% and 10% respectively compared with the misola and OFSP pure flours.

Keywords*:* OFSP extracts, total antioxidant content, total polyphenolic content, total carotenoid content, FRAP, FCR

Structure of Sweet Potato (*Ipomea batatas*) Diversity in West Africa as Explained Partly By a Climatic Gradient

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Sub-Saharan agriculture has been identified as vulnerable to ongoing climate change. Adaptation of agriculture has been suggested as a way to maintain productivity. Better knowledge of intra-specific diversity and adaptation of varieties are prerequisites for the successful management of such adaptation. Among crops, root and tubers play important roles in food security and economic growth for the most vulnerable populations in Africa. Here, we focus on sweet potato. Sweetpotato (*Ipomoea batatas*) was domesticated in Central and South America and was introduced later into Africa and is now cultivated throughout tropical Africa. We evaluated its diversity in West Africa by sampling a region extending from the coastal area of Togo to the northern Sahelian region of Senegal that represents a range of climatic conditions. Using 12 microsatellite markers, we evaluated 132 varieties along this gradient. We also obtained phenotypic data from field trials conducted in three seasons. Genetic diversity in West Africa was found to be 18 % lower than in America. Genetic diversity in West Africa is structured in five groups, with some groups found in very specific climatic area, e.g. under a tropical humid climate, or under a Sahelian climate. We also observed genetic groups with occurrence in a wider range of climates. The genetic groups observed were also associated with morphological differentiation, mainly the shape of the leaves and the color of the stem or root. This particular structure of diversity along a climatic gradient can be used to propose conservation strategies as well as to recommend specific varieties to be grown in current and future climate conditions. This knowledge will help adapt agriculture to ongoing climate variation in West Africa.

Keywords: Agro-morphology, Climate, Genetic diversity, *Ipomoea batatas*, West Africa

Evaluation of Resistance of Sweetpotato Varieties to *Cylas puncticollis* Boheman (*Coleoptera*: *Apionidae*) Weevil in Burkina Faso

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In Burkina Faso the production of sweetpotato varieties with orange flesh is less important than those of white-fleshed varieties. This lower production is due to the fact that most of these varieties are more susceptible to weevils the *Cylas puncticollis* Boh whose damage is the main constraint in the production of this crop. Field trials were conducted during the 2013 -2014 season in two locations (Mouna and Benaverou) in the southern Sudan region of Burkina Faso to assess sweet potato variety field susceptibility to the *Cylas puncticollis* Boh weevil. Thirty newly improved and local varieties were used in this experiment in a randomized complete block design with 4 repetitions at both sites. Following this assessment, lab screening was performed at the Central Laboratory of Agricultural Entomology of INERA Kamboinse with four improved varieties and two local varieties. The average temperature in the laboratory was 29,43±2,71°c and the relative humidity of 27,64±5,36. The susceptibility and performance of some improved varieties as *BF77**Tainung-10, *CAROMEX*, *TIB40060*, *TIEBELE*-2, *JEWEL*, were not significantly different ($P < 0.05$) from those of the local varieties: *BF18, BF59* and *BF51*. The laboratory screening showed that *CAROMEX* and *TIB40060* varieties are the most preferred by weevils. The orange-fleshed varieties *JEWEL, TIB-440060, BF59×CIP-4* reaction was not significantly different ($P < 0.05$) to the more tolerant check local varieties to the weevil *BF59* and *BF18*.These improved orange-fleshed varieties could be included in the breeding program for resistance to sweetpotato weevil.

Keywords: *Cylas puncticollis*, Burkina Faso, sweetpotato, variety, resistance

Effect of Sowing Depths on *Cylas spp* Infestation on Some Sweetpotato Varieties

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Studies were conducted to determine the effect of sowing depths on *Cylas* infestation of four sweetpotato varieties *Sauti, TIS 8266, TIS 84/0320 and TIS 3017*. Data were taken on number of leaves and branches on top 30cm, vine thickness, internode length, soluble sugar and dry matter content. The population levels of *Cylas spp* investigated on the sweetpotato varieties after planting increased from 2nd, 3rd to the 4th month. There was significant increase in the incidence of weevil *(P<0.001)* with time on the four sweetpotato varieties. The tuber stalk length of the four sweetpotato varieties measured at harvest was highly significant *(P<0.001)*. The level of tuber infestation of the four sweetpotato varieties by *Cylas spp* decreased with increasing depth of planting .This may explain why sweetpotato varieties with long tuber stalk had the least incidence of *Cylas spp*. The results also indicated that the sweetpotato variety which had the highest number of leaves and branches, as well as the thickest vine had the highest incidence of vine infestation at 5% significant level *(P<0.05)*.The sweetpotato varieties used had varying levels of soluble sugar and percent dry matter at 5% significant level.

Keywords; Dry matter, soluble sugar, sweetpotato, weevil,

Effect of Compost Mounds and Chemical Fertilizer on Yield of Sweet Potato

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Sweet potato is a minor crop in many farming communities in Ghana. Farmers depend on natural fallow to grow the crop which is not sustainable. Farmers in Papua New Guinea have for centuries used compost mounds to maintain soil fertility and sustain sweetpotato yields. Compost mound is a mound incorporated with a quantity of dry weed residues. A study was conducted in 2015 at Ejura and Amanten to determine the effects of compost mounds formed from groundnut residues and chemical fertilizer on yield of sweetpotato. The experimental design was a randomized complete block with 3 replications per site and the treatments were i) major season maize followed by minor season sweet potato, no residue incorporated nor chemical fertilizer (maize with no fertilizer); ii). major season maize followed by minor season sweet potato, with residue incorporated in mounds plus chemical fertilizer (maize with fertilizer); iii) major season groundnut followed by minor season sweetpotato with residue incorporated nor chemical fertilizer (groundnut with no fertilizer) and iv) major season groundnut followed by minor season sweet potato with residue incorporated plus chemical fertilizer (groundnut plus fertilizer). At land preparation in the minor season, weed incidence was significantly lower on the plots previously planted to groundnuts compared with the maize plots. Incorporation of residues in mounds did not affect sweetpotato yields but chemical fertilizer significantly improved yields.

Keywords: Compost mound, Sweetpotato, residue incorporation, chemical fertilizer.

Potato Value Chain Development with Farmers: Its Role to Avert Hunger and Attain Food Security in North Western Ethiopia

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Potato is a food security crop. It plays an important role in addressing the seasonal food deficit experienced during the months of August through September in Ethiopia because of its short crop cycle (90-120 days). Potato has high yield potential, enjoys huge demand for local market and it is known for its high nutritional value. However, due to several constraints, its yield has been limited to less than 8 tons ha^{-1} at farmers' fields. Among others, traditional potato production system is plagued with; high incidence of disease and pest (bacterial wilt and late blight); shortage of seed for adaptable and disease tolerant varieties; low productivity of local varieties; limited knowledge on post harvest handling and management (poor storage and transport facilities); lack of skill on food preparation and utilization and poor innovative technology transfer systems are the major ones. The capacity building for scaling up of evidence based best practices for Ethiopia (CASCAPE) project, serving as a speed boat for the flag ship of Agricultural Growth Program (AGP), focused on developing potato value chain from planting to marketing and consumption with farmers for four years (2011-2014) in four districts. The participatory policymakers-farmers-research-extension group approaches were followed. Following this approach, the project developed innovation system that was found to be successful. The system comprised of logical steps that were implemented in three years time. These include; 1) Participatory evaluation and demonstration of improved potato technologies. In the first year of CASCAPE project intervention, seven different released varieties against a local check were demonstrated and evaluated by farmers' research group (FRG) organized in South Achefer and Burie districts. As per farmers' evaluation for yield and cooking quality, *Belete* variety was selected. 2) Participatory informal seed multiplication and dissemination. Based on the first year result of evaluation, the project multiplied seed of *Belete* variety that were distributed to the FRG team members. 3) Scaling-up the potato production package to other farmers' fields. The multiplied seed by FRG model farmers was distributed to selected other farmers who were chosen from the community in the two districts. Around each farmer, 20 famers were organized as a new FRG team. 4) Construction of diffused light store (DLS) and table potato store. Farmers received training on the construction of DLS for seed storage and potato store to keep potato for food and selling it at later stage when prices rise. 5) Training on food preparation. Farmers were given training on food preparation by development agents and project experts. It was possible to prepare sauce, porridge, Injera (local bread) and chips from it. 6) Linking with the market. Large tubers were sold to the market for food in high demand period of the year while small sized tubers were stored in DLS and later sold for planting next year among FRG members and beyond. Following this approach yield of potato was raised from 7 to 39 tons ha-1 and their income increased significantly. A farmer producing 39 tons ha-1 could obtain 585,000.00 Birr ($27,000) if he sold potato for seed and 195,000.00 Birr ($9,285.00) if he sells it for food. From the three years experience, we have seen that the innovation system was adopted by farmers and development workers and helped the farmers to improve their livelihood. Ultimately, several farmers shifted from hunger stricken to food secured households. The innovation system has been documented as a manual and made available to the extension system. Hence, this approach can be scaled up to other similar agro-ecologies and farming systems of Ethiopia.

Analysis of the Main Marketing Constraints for Frafra Potato and their Income Implications for Smallholder Farmers

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Frafra potato (*Solenostemon rotundifolius*) is a herbaceous species of the family of *Lamiaceae*. It is cultivated in the tropical regions of Asia and Africa, mainly by the small holder farmers, as a subsistence tuber crop. The crop is grown both for home consumption and also sold to supplement household income. In Burkina Faso, Ouagadougou is known to be an important city of consumption of frafra potato. Previous research activities have revealed that profits made from marketing of frafra potato is decreasing compared to that of other tuber crops (yams, sweetpotato). A survey was conducted in 2015 in the main markets of Ouagadougou to identify the main marketing constraints for frafra potato. The rapid tuber deterioration and the lack of improved methods for conservation, the small size of frafra potato tubers and the short period of tubers availability on the markets were identified to be the main constraints of frafra potato. The average tubers diameter varied from1.2 to 2.4cm and the length from 2.7 to 4.2cm. Most of the tubers were small-sized(less than 1.8cm of diameter) making it very difficult for farmers to sell. The frafra potato variety with black skin color is identified to be the preferred variety. Future breeding program should be to increase tuber size.

Keywords: Frafra potato, marketing constraints, tuber size.

Adoption Potential of Improved Sweetpotato Varieties in Ghana

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Root and tuber crops are essential staple crops produced in the West African sub- Region.The West African Agricultural Productivity Programme funded by the World Bank seeks to improve root and tuber crops to ensure increased productivity, food security and poverty alleviation. The first phase ended with the released of 4 improved sweetpotato varieties (*Ligri, Bohye, Dadanyuie, Patron*) with higher productivity compared to other varieties in existence. Potentia ladoption study is necessary to aid dissemination of the varieties by identifying varietal traits that could drive the adoption and varietal choices across various locations. The study employed qualitative approach (Participatory Rural Appraisal) involving 126 farmers randomly selected from a purposive pool of sweetpotato farmers from four major sweetpotato growing areas (Akatsi, Komenda, Ohawu and Asempanaye). Males (59.6%) dominated in sweetpotato production across location and a youth representation of 40% of the total sampled size which is a good indication for sweetpotato production. Sweetpotato production is more pronounced in the minor season (August-September) on an average farmsize of 1.5acres (0.6ha) using local and improved varieties (*Sauti, Santompona, Faara and Apomuden*). Major pest that affected crops were Swetpotato weevil (50% yield loss), Grasshoppers (30% yield loss) and Caterpillar (20% yield loss).Pesticides (Acetelic 50EC) was extensively used in pest control. Farmers perceived that, excessive use of pesticides had a negative effect on the sweetpotato yield and quality. Mean yield per hectare was 3.3tons (3000kg). Based on major and minor season prices, the highest profit was made in the minor season. Mean total cost per hectare was GH₵1,925.00 in the major season and GH₵2,812.50 in the minor season; Revenue, GH₵4,050.00 and GH₵6,600.00 and Gross Margin was GH₵2,125.00 and GH₵3,787.50 respectively. Komenda preferred *Dadanyuie* (85%) and *Patron* (62%); Ohawu preferred *Bohye* (85%) and *Dadanyuie* (76%), Asempanaye preferred *Patron* (76%) and *Bohye* (70%); Akatsi farmers preferred *Dadanyuie* (76%) and *Bohye* (61%) based on the varietal characteristics deemed ideal for farming conditions, increasing output and subsequently income. Optimum adoption of a new variety requires the consideration of location variety choices, training on good agricultural practices, education on the traits of the new variety and proper marketing techniques.

Keywords: Sweetpotato, Gross Margin, Varietal Choices, Potential Adoption.

Etude de référence les filières manioc et patate douce au Mali

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Les cultures céréalières constituent la base de l'alimentation au mali. Cependant, malgré les progrès réalisés dans ce domaine en matière d'amélioration de la productivité, l'autosuffisance et de la sécurité alimentaire sont loin d'être atteintes dans le pays. La très grande consommation des racines et tubercules pendant les courtes périodes de grande disponibilité indiquent que ces denrées alimentaires peuvent jouer un rôle important dans l'atteinte de cet objectif. En effet, de nombreux observateurs indiquent que les racines et tubercules, grâce à leurs potentialités élevées de production, de transformation et de qualité nutritionnelle, peuvent fortement contribuer à atteindre l'autosuffisance et la sécurité alimentaire dans les pays sahéliens comme le Mali. Le manioc, la patate douce, l'igname sont des plantes à tubercules dont l'amélioration de la productivité à travers des investissements en recherche, peuvent apporter une contribution significative à la croissance agricole du Mali. Le WAAPP à travers la création des Centres nationaux de spécialisation, notamment celui des racines et tubercules du Ghana a offert l'opportunité au Mali de développer une étude sur ces cultures en 2011-2013. Son objectif est de contribuer au développement de la production de ces deux cultures au Mali. Les activités ont porté sur (i) une étude diagnostique réalisée sur les marché et auprès des exploitations agricoles dans les régions de Sikasso, Ségou, Koulikoro, Mopti et Kayes; (ii) la mise en place des collections de manioc et de patate; (iii) la mise en place dans la zone de Sikasso, des essais d'évaluation des écotypes maliens et des variétés provenant du Centre National de Spécialisation du Ghana. La collection de manioc a été mise en place au cours de la campagne 2011-2012 avec 4 variétés du Ghana composées de Sika, Doku, Bankyehema et Ampong et 5 écotypes du Mali qui sont Loulouni I, Loulouni II, Loulouni III et Farako. Le matériel végétal utilisé pour la patate douce était constitué essentiellement d'écotypes locaux collectés auprès de certains paysans de la région de Sikasso. Les résultats de l'étude diagnostique montrent qu'au niveau des exploitations agricoles, les deux cultures sont faiblement intensifiées avec l'utilisation d'équipements agricoles et des techniques culturales traditionnels. Les superficies moyennes des deux cultures par exploitation au niveau des champs collectifs sont faibles et varient de 0, 5 ha à Mopti à 1,48 ha à Sikasso. Hormis la zone de Ségou où des doses élevées de fumure organiques (27300 kg/ha) sont appliquées par certains producteurs sur le manioc, l'utilisation de la fumure est très limitée sur ces deux cultures dans les autres régions. L'étude a permis de dénombrer l'existence de 33 écotypes de patate douce et de 24 écotypes de manioc dont les origines ne sont pas connues par les producteurs. En ce qui concerne la commercialisation, le manioc produit au Mali est localement écoulé contrairement à la patate douce qui est exportée vers le Sénégal, la Mauritanie et le Ghana et également vendue dans toutes les régions du Mali pour le cas de la patate douce produite à Sikasso. Les principales contraintes au développement de ces cultures sont en autres, la présence des nuisibles dont les maladies virales sur le manioc, la mauvaise organisation de la filière et les faibles niveaux technique et d'équipement des exploitants pour la production, la transformation et de conservation. Les résultats agronomiques montrent que les variétés ghanéennes ont donné des rendements compris entre 52 et 68 tonnes par hectare. Les meilleurs rendements ont été obtenus avec les variétés Doku (68 T/ha) et Ampong (61 T/ha). Les rendements des écotypes maliens ont varié entre 30 et 46t/ha. Pour la patate douce la locale de Bilasso a obtenu le meilleur rendement avec 18 t/ ha. Les résultats de l'étude diagnostique ont permis d'adresser des recommandations à la recherche et au développement. Il s'agit de :

- compléter les prospections et faire une caractérisation morphologique et moléculaire pour les identifier avec précision.
- entreprendre des études approfondies sur les potentialités des écotypes qui existent au niveau des producteurs ;
- définir une fertilisation organo-minérale en fonction des systèmes de culture et des zones agro-écologiques;
- réaliser des études plus approfondies sur les nuisibles et déterminer leurs incidences;
- entreprendre des études sur les bonnes méthodes de conservation du manioc et de la patate douce et tester ces méthodes dans les zones de l'étude ;
- Orienter les travaux de recherche vers le raccourcissement du cycle ;
- entreprendre une étude de détermination du coût de production de chaque culture.
- mettre en place des plateformes d'acteurs (commerçants de produits et d'intrants, producteurs, transformateurs, etc.) par localité.

Keywords: Productivité, filière, manioc, patate douce, sécurité alimentaire, Mali.

English Translation

Baseline study on cassava and sweetpotato industries in Mali

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Cassava, sweetpotato, yam are root and tuber crops whose productivity improvement through investment in research, can make a significant contribution to agricultural growth in Mali. WAAPP through the establishment of National Centers of Specialization, including that of roots and tubers in Ghana provided the opportunity to Mali to develop a study on these crops in 2011-2013. The objective was to contribute to the development of the production of these two crops in Mali. The activities focused on (i) a diagnostic study of the market and from farms in Sikasso, Segou, Koulikoro, Mopti and Kayes region; (ii) the establishment of cassava and potato collections; (iii) the establishment in the Sikasso region, evaluation trial of Malian landraces and varieties from the Ghana National Centre of Specialization. Cassava collection was implemented during the 2011-2012 campaign with 4 varieties from Ghana which are Sika, Doku, Bankyehema and Ampong and 5 varieties from Mali which are Loulouni I Loulouni II, Louloun III and Farako. The planting material used for sweetpotato consisted mainly of local landraces collected from some farmers in the Sikasso region. The results of the diagnostic study show that at the farmer's level, the two crops are weakly intensified with the use of agricultural equipment and traditional farming techniques. The average area of the two crops per farm in collective fields are low and vary from 0, 5 ha in Mopti to 1.48 ha in in Sikasso. Apart from the Segou region where high doses of organic fertilizer (27300 kg/ha) are applied by some farmers on cassava, the use of fertilizer is very limited on these two crops in other regions. The study enumerated the existence of 33 varieties of sweetpotato and cassava 24 varieties whose origins are not known by farmers. Regarding marketing, cassava produced in Mali is locally elapsed unlike sweetpotato that is exported to Senegal, Mauritania and Ghana and also sold in all parts of Mali in the case of sweetpotato produced in Sikasso. The main constraints to the development of these crops among others are, the presence of harmful viral diseases including cassava diseases, poor organization of the sector and the low technical levels and operators of equipment for the production, processing and preservation. The agronomic results show that the varieties from Ghana have yields between 52 and 68 tonnes per hectare. The best yields were obtained with Dokuvarieties (68 t/ha) and Ampong (61 t/ha). Yields from Mali varieties ranged between 30 and 46t/ha. For sweetpotatoes Bilasso had the best performance with 18 t/ha. The results of the diagnostic study helped to make recommendations for research and development. They are to:

• complete the surveys and make morphological and molecular characterization to identify them accurately.
• undertake detailed studies on the potential of varieties that exist at the farmers level;
• define an organo-mineral fertilizers based on cropping systems and agro-ecological zones;
• Conduct further studies on harmful pests and determine their impact;
• undertake studies on best methods of conservation of cassava and sweetpotato and test these methods in the study areas;
• Direct research work towards shortening the cycle;
• undertake a study determining the cost of production of each crop.
• set up of stakeholder platforms (traders and inputs dealers, producers, processors, etc.) by locality.

Keywords: Productivity, cassava, food security, Mali.

Physicochemical and Functional Properties of Flour from Twelve Varieties of Ghanaian Sweetpotatoes

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Sweetpotato (*Ipomoea batatas*) is an important crop in Ghana after cassava and yam on quantities produced yearly. The development of new varieties for food and industrial uses has spread the cultivation of sweetpotato in all the regions of Ghana. In the study, the physicochemical and functional properties of flours developed from 12 varieties of sweetpotatoes were determined. Colour determination indicates *Apomuden (AP)* variety as the darkest (L* values 83.6) and *Ligri* (*GR)* variety as the lightest (L* values 89.4) of the flours. The moisture content of the sweetpotato flours ranges from 7.6 to 10 % below 15 % specified for flours. Water activity (a_w) ranged was 0.5 and 0.6, an indication of shelf-stable flours. The sweetpotato varieties peculiarities influenced the differences in moisture and water activity. The varieties *Faara* (*CFA)* and *Sauti* (*SAT),* which had high amounts of moisture were also similar in their water activities. The pH of the flours were 5.8 to 6.2 correspondingly to *SAT* and *(Otoo) OT* varieties, indicating low acidity. Variations in swelling power, water solubility index and water binding capacity were 4.6 - 5.9 g/g, 3.4 - 9.7 % and 87.5 - 114.6 %, respectively. The flours showed good water solubility and binding indices of important for flours. The flours indicated easy-to-cook properties as their pasting temperature was between 79 and 84 °C whereas peak viscosity and setback ratios varied from 75 – 304 RVU and 1.38-1.66, respectively.Interestedly, the 12 varieties of Ghanaian sweetpotatoes possess good physicochemical and functional properties that makes them applicable in wide array dietary and industrial purposes.

Detection of Sweetpotato Viruses on Weed Species from Sweetpotato Fields in the Forest and Coastal Savanna Agro-Ecologies of Ghana

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One of the major constraints to sweetpotato (*Ipomoea batatas*) production is the incidence of viruses which adversely affect the productivity of the crop. There have been consistent efforts over years to manage and mitigate the incidence of these viruses in farmers' fields. The use of disease-free planting materials, timely planting, elimination of insect vectors using chemicals among other measures has been promoted as management strategies. Another important approach that can help manage or minimize the incidence of viral infection on sweetpotato is to identify weed species that serve as alternate hosts to these viruses and then advise farmers on the need to eliminate these weed species from their fields. Seven weed species (yet to be identified) showing symptoms of viral infection were collected from farmers' fields in the Eastern region (Akrumso, Begoro, and Assesswa), Volta region (Tadzevu, Lume, and Ohawu) and Central region (Jukwa and Hiama Nkyene) of Ghana. Leaf samples of these species showing varying symptoms of viral infection were collected, kept on ice and then brought to the laboratory for analysis using nitrocellulose membrane(NCM)-enzyme linked immunosorbent assay (ELISA) and polymerase chain reaction (PCR) techniques. Preliminary results of the laboratory diagnostics have revealed the presence of five of the most common sweetpotato viruses namely Sweetpotato feathery mottle virus (SPFMV), Cucumber mosaic virus (CMV), Sweetpotato, mild mottle virus (SPMMV), Sweetpotato chlorotic stunt virus (SPCSV) and Sweetpotato chlorotic flecks virus (SPCFV). Farmers will be advised on need to destroy the identified weed species from their fields.

Keywords: *Sweetpotato viruses, NCM ELISA, alternate host, agro-ecologies*

Boosting Orange Fleshed Sweetpotato productivity and Dissemination of best practices using simple technology in the Eastern region of Burkina Faso

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Malnutrition remains a significant public health concern in Burkina Faso, 10.4 % of children are acute and 30.2 % are stunted, while 26.8% suffer from Vitamin A deficiency. As studies have proved the contribution of Orange-fleshed sweet potato (OFSP) in addressing vitamin A deficiency, Helen Keller International promotes its production, consumption, vine multiplication and facilitates value chain development in 60 villages and 20 schools of the Eastern region of Burkina Faso. OFSP production in the Sahel faces three major constraints, namely lack of improved sweet-potato varieties, shortage of healthy planting materials and shortage of water during dry season. Five improved vitamin A rich OFSP varieties together with the use of best agricultural practices were introduced and disseminated through village model-farms, school gardens and vine multipliers. Farmers were trained in OFSP production techniques, composting, grass mulching, water conservation, and irrigation techniques to produce during dry and rainy seasons. Five demonstration plots were established, and four village leader farmers trained around 40 women beneficiary in each of the 60 villages. Additional training topics included cooking demonstration, essential nutrition actions and hygiene. In total about 2.000 households and ten schools parent associations were reached. Preliminary findings show major successes after one year of implementation relating to improved techniques and varieties, vine distribution, women leadership in OFSP training. Vine multipliers provided 700.000 cuttings from April to July 2015 and sold it for more than 5 million FCFA. For the rainy season campaign, at least, 85 tons of tubers were produced representing 19 tons of yields per hectare, on average 42 kg of OFSP per beneficiary. Some vine multipliers and producers use affordable micro-irrigation systems for vine multiplication and tuber production during dry season. This experience shows that even in challenging environments, OFSP production and vine dissemination can succeed despite some constraints related to viruses, land and water availability. The 5 OFSP varieties tested are accepted by the community as a result of their yield potential and organoleptic properties.

Keywords: Essential Nutrition Action, cuttings, dissemination, good practices, OFSP, organoleptic, village model farm, village leader farmers, vine multipliers

Breeding of Frafra potato (*Solenostemon rotundifolius* (Poir) for yield, high nutrient composition and resistance to nematodes

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Frafra potato (*Solenostemonrotundifolius*) is an important tuber crop cultivated and consumed in Sahelian regions of West Africa. It is rich in protein and micronutrients and have medicinal properties due to the presence of flavonoids. Despite the nutritional and medicinal value of frafra potato, the crop is neglected and farmers still cultivate landraces which are low yielding and susceptible to diseases and pests. To promote and develop improved varieties, this project was carried out to study ethnobotany and to evaluate fifteen accessions of the crop for yield, nutrient composition and nematode resistance. Ten districts belonging to diverse ethnic and agro-ecological zones were surveyed using participatory rapid appraisal tools. Using randomized complete block design, the fifteen accessions were evaluated for yield and resistance to nematodes and their tubers were analyzed for proximate and mineral composition using recommended standard protocols. From the survey data, several vernacular names were recorded and their meaning refer to the food and medicinal value of the crop. Some local varieties have been abandoned suggesting genetic erosion of frafra potato in the surveyed areas. The crop was used to treat stomach problems, sore throat and eye disorders. Lack of planting materials and elite varieties, low yield (small size of tubers), and pests and diseases were the main constraints highlighted by the farmers. Significant variation ($P<0.05$) was observed among the accessions for size of tubers, weight of tubers and number of tubers per plant. Also there were significant differences among the accessions for proximate and minerals composition and resistance to nematodes. This indicates that the accessions vary in these traits and present an opportunity to select frafra potato genotypes with desirable traits for further improvement. Genotypes *QA99005, ACC2001008, QA99016 and QA99014* were high yielding, high in nutrient composition and resistant to nematodes and are being currently evaluated for further development of improved cultivars of frafra potato in Ghana.

Keywords: Breeding, Ethnobotany, Frafra potato, Ghana, Nutrition, *Solenostemon rotundifolius*, Yield

Détermination of the Effects of Carotenoids Structures on the Conservation of Orange fleshed Sweetpotato

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Orange-fleshed Sweetpotato contains carotenoids that are responsible for its nutritional value and beneficial effects on consumer health. Orange fleshed Sweetpotato tubers, with their high water content, are very highly perishable in tropical conditions and therefore have a short time of conservation. This very rich culture in substances provitamins A including some carotenoids, more helps the biofortification of infant flours local processings in Burkina Faso. Then, transformation is a strategic link that could stimulate development of consumption, marketing and production. But the conservation of fresh tubers through different chains of value is still problematic. This work aims to identify the best conditions of conservation of these semi-finished products. By coupling TLC/MS (Thin Layer Chromatography/Mass Spectrometry) made with CAMAG TLC-MS interface, five molecules of carotenoidssuch as β-carotene, α-cryptoxanthin, β-cryptoxanthin, lutein, and zeaxanthin and possibly the isomers of β-carotene (α-carotene, ε-carotene, γ-carotene and lycopene) have been identified in extracts of Orange fleshedsweetpotatoflour. Total carotenoid retention rates are passedfrom 84.13% under freezer conservation (SF) conditions to 27.39% and 26.10% under MATC and MADC conservation conditions respectively for fourteen weeks. Stronglycorrelated (R = 0.94) to total carotenoids contents (TCC), total antioxidantcontents (TAC) are preserved at 73% ($P < 0.05$) in freezer conservation conditions, the mostsuitable to prevent carotenoids from photooxidation phenomena. In these conditions, antioxidant micronutrients which are responsible of its nutritional value could be preserved up to 72% for six months of storage. This type of conservation thus appears to be an alternative for the transformative facing difficulties of conservation of fresh tubers.

Keywords: TLC-MS, Folin-Ciocalteu Reagent, antioxidant, phenolics

Genotyping of released and elite Sweetpotato varieties using Simple Sequence Repeats (SSRs) and Expressed Sequence Tags (ESTs)

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Sweet potato (*Ipomoea batatas)* is the seventh most important crop in the world. In this study a DNA Amplification Fingerprinting (DAF) approach was employed to develop individual-specific profiles and analyze genetic relationships among the germplasm collected.DAF is useful in sweetpota to germplasm characterization and this was employed to identify duplicate accessions. Two sets of microsatellites which are Simple Sequence Repeats (SSRs) and Expressed Sequence Tags (ESTs) were used in this study. SSRs were used based on total genomic information whereas ESTs were based on expressed gene information. Twenty genotypes of sweet potato (*Ipomoea batatas)* which comprised twelve released varieties and eight elite lines were used for this study. A total of fourteen ESTs and twenty two SSRs were screened to determine those that would give reproducible bands at expected molecular size. Fourteen ESTs and ten SSRs were selected and used to fingerprint the twenty accessions. Data generated revealed different clustering for the two sets of markers used. ESTs markers clustered the released varieties together with the elite line Jewel. However the SSR markers clustered Jewel together with two other elite lines in one group. No duplicates were identified in the collection. In conclusion the two marker systems used clustered the varieties differently, therefore depending on the research objective; the appropriate marker system should be used.

Keywords: DAF, DNA, ESTs, Fingerprinting, SSRs