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# **Mobility for Plant Genomics Scholars to Accelerate Climate-Smart Adaptation Options and Food Security in Africa (GENES)**

## **TECHNICAL MEETING**

(Selection of second cohort, Annual report revision  
and PhD projects review)

**IN UNIVERSITY OF YAOUNDE I, CAMEROON**

**Date: 02<sup>nd</sup> – 06<sup>th</sup> September 2019**

## **SPONSORS**



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## **Mobility for plant genomics scholars to accelerate climate-smart adaptation options and food security in Africa (GENES)**

### **GENES Project**

Genomics is a sharp and fairly recent scientific area that provides more precise, quick, non-expensive tools to complement classic breeding approaches. African universities are missing in action in the progress observed in genetics and molecular breeding worldwide due to low capacity and facility in utilizing genomic tools. The need to increase the number of plant genome experts by increasing the number of trained and qualified molecular plant breeders cannot be over-emphasized.

**GENES** offers opportunity for **training young scholars** to equip them in designing and developing molecular approaches to breeding in the face of climate change. The GENES consortium links with **pivotal Anglophone and Francophone universities and research institutions** with adequate expertise/potential in the areas of genomics to achieve the objectives of the project.

**Consortium Partners** include **Ebonyi State University in Nigeria** (the Coordinating institution), University of Abomey-Calavi in Benin, Jimma University in Ethiopia, University of Yaunde 1 in Cameroon and Wageningen University in the Netherlands that doubles as the Technical Partner to the Consortium.

**Scientific Collaborators** include University of KwaZulu Natal (South Africa), Centre for International Cooperation in Agricultural Research for Development (CIRAD), International Institute of Tropical Agriculture (IITA, Ibadan), BecA-ILRI (Kenya), African Plant Breeding Academy (AfPBA), UC Davis, MontpellierSupAgro and Plant Breeding E-learning Africa (Iowa State University).

GENES is funded by the Intra-Africa Academic Mobility Program of the Education, Audiovisual and Culture Executive Agency (EACEA) of the European Commission.

### **Objectives of GENES Program**

- 1) Produce 10 world-class molecular plant breeders that will accelerate cultivar development to adapt to current and future challenges related to climate change and food and nutrition insecurity in Africa,
- 2) Train next generation of 36 high skill genomics scientists with strong capacity in cultivar development and new molecular breeding approaches,
- 3) Harmonize training programs and research agenda on the use of genomic breeding to accelerate cultivar development and increase the resilience of crop production systems,
- 4) Foster national – regional – global collaboration and programmatic agenda that promote genomic breeding research and training for agricultural innovations within Africa.

**"We train the next generation of genomics scholars to accelerate climate-smart agriculture for food security in Africa"**

**Target is gender balance in recruitment of scholars: 50 % Male and 50% Female Candidates:**

- 5 female PhD students
- 5 male PhD students
- 18 female MSc students
- 18 male MSc students
- 8 academic technicians





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### Graduate Degree options offered

MSc in Plant Breeding & Genetics

MSc in Plant Biotechnology

MSc in Biotechnology and Plant Breeding

MSc in Seed Technology

PhD in Plant Breeding & Genetics

PhD in Plant Genetic Resources and Crop Protection

PhD in Plant Biotechnology

MSc in Horticulture

### Scholarship Offers

- Monthly stipend: Euro 600 for Masters, Euro 900 for PhD students and Euro 1200 for staff.
- Research fund: Euro 600 for Masters and Euro 2000 for PhD students
- Participation cost: Euro 3500 for MSc and Euro 4000 for PhD students
- Monthly Insurance

### Expected Outcome

- At individual level, scholarship holders will develop or increase their knowledge in novel plant breeding and genetics for the benefit of the agricultural sector.
- Scholars will strengthen their competence and leadership to engage into new opportunities in the agribusiness sector.
- The project will promote bilingual aptitude in students throughout the implementation of the programme. Expansion of foreign language study will be reinforced.
- At institutional level, GENES offers opportunity to enlighten recognition of studies and enforce the application of academic credit transfers amongst African Institutions.
- A platform for curriculum improvement through cooperation among top universities in Sub-Saharan Africa is provided.
- New PhD holders become part of the academic staff of their Home institutions or contribute to research in CGIAR Centres, or seed companies.
- At the national/regional level, we promote (or continuously advocate for) breeding neglected and underutilized crops for food and nutrition security. Tackling local needs with local resources using genomics is central to the program.
- Gender diversity will be addressed when member institutions become committed to promoting gender equity and thus give priority to female students and economically disadvantaged ones.
- Success stories from GENES scholars will be largely communicated to the public as a strategy to disseminate project outputs, transform agriculture and attract new donors.



GENES Partners and EU Project Rep





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## **GENES Intra-Africa Academic Mobility Project EACEA/2017/2552**

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### **GENES - Mobility for Plant Genomics Scholars to Accelerate Climate-Smart Adaptation Options and Food Security in Africa**

**Technical meeting in University of Yaounde I, Cameroon**  
(Selection of second cohort, Annual report revision and PhD projects review)

**Date:** 02 – 06 September 2019

#### **Participants**

Hermine NGALLE BILLE, University of Yaounde I, Cameroon

Wosene G. ABTEW, Jimma University, Ethiopia

Happiness OSELEBE, Ebonyi State University, Nigeria

Eric SHRANZ, Wageningen University, The Netherlands

Enoch ACHIGAN DAKO, University of Abomey-Calavi, Benin

Christel AZON, University of Abomey-Calavi, Benin

Celestine AFIUKWA, Ebonyi State University, Nigeria

Joseph Martin BELL, University of Yaounde I, Cameroon

#### **Advising scientific committee**

Prof. Leonard AFOUDA (Parakou, Benin). He will be available through Skype.

Prof. Joseph Martin BELL (University of Yaounde I)

Dr. David CROS (CIRAD/CETIC)

Dr. BALOUA NÉBIE (ICRISAT)

Dr. Joël Romaric NGUEPJOP (University of Yaounde I)



## GENES Intra-Africa Academic Mobility Project EACEA/2017/2552

# AGENDA

Time	Activity	Speakers
<b>Monday 2<sup>nd</sup> September 2019</b>		
<b>09:00 – 10:00</b>	<b>Welcoming Session</b>	
09:00 – 9:30	Official opening	Dean of the Faculty of Science
	Presentation of the participants Objectives of the meeting	Dr. Hermine NGALLE BILLE
09:30 – 10:00	Family Picture and Coffee Break	
10:00 – 10:45	<b>GENES Program Overview</b>	
	Summary of GENES objectives, activities and main results. Output: thematic of research projects – Crops studied – Mobility and its relevance crops and tools – Challenges. Assessing administrative and financial progress	Prof. Happiness OSELEBE
10:45 – 12:30	<b>Report on ongoing selection</b>	
	Output: Selection of cohort 2 MSc students	Prof. Happiness OSELEBE
12:30 – 14:00	<b>Lunch Break</b>	
14:00 – 17:30	<b>Selection Session</b>	
14:00 – 16:30	Selection of candidates(2 <sup>nd</sup> cohort) Discussion on the launch of next call	Chair: Prof. Enoch ACHIGAN-DAKO
16:30 – 17:30	Writing the minutes of the selection and signature	Christel AZON Dr. Celestine AFIUKWA



### **GENES' MSc Candidate**



**Norman Munyengwa**

BSc

**Home Country**

Zimbabwe

**Supervisor**

Dr. Hermine Ngalle<sup>1</sup>

Dr. David Cros<sup>1</sup>

Dr. Edmore Gasura<sup>2</sup>

<sup>1</sup>University of Yaounde, Cameroon.

<sup>2</sup>Chairperson, Department of Crop Science, University of Zimbabwe.

**Crop of interest**

Rubber tree (*Hevea brasiliensis*) is one of the most important crops in the world as it provides 99% of the rubber used in the world of which 70% is used in the tire industry and the remaining 30% is used in the healthcare sector. Natural rubber is a major ingredient for more than 50,000 household, healthcare and industrial products that have elasticity as a functional attribute. In Africa, Ivory Coast is the leading producer of natural rubber and it holds 7<sup>th</sup> position at the global level.

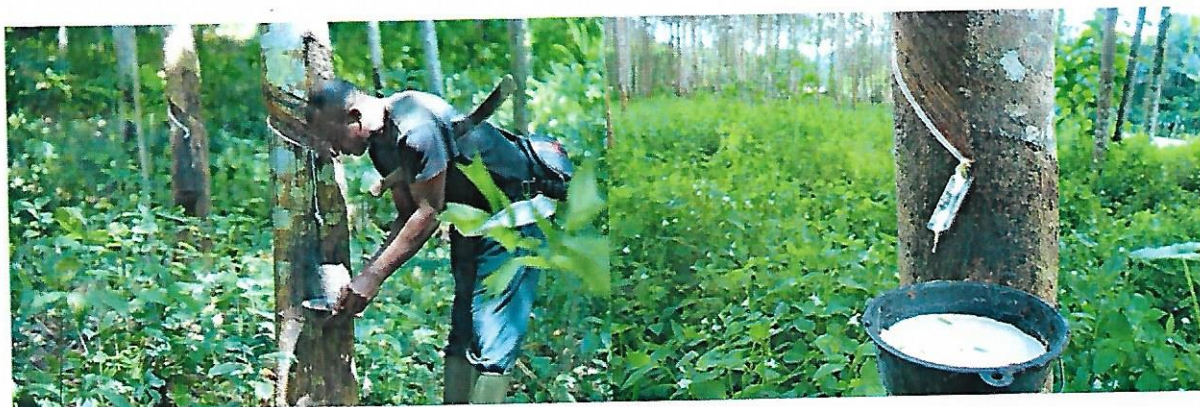
**Project title**

Genomic selection in rubber tree (*Hevea brasiliensis*) using single nucleotide polymorphisms (SNPs) marker data obtained from Genotyping-by-Sequencing (GBS).



## Summary of proposal

The major challenge faced by rubber breeders is the very long breeding cycle which can last for 30 years. The three phenotypic based selection stages in rubber are responsible for the very long breeding cycle. The use of QTL-based markers to improve rubber yield has not been successful due to difficulties in estimating QTL  $\times$  environment interactions. Genomic selection, which is a next generation, state-of-the-art approach of marker-assisted selection has huge potential to improve rubber yields and to reduce the generation interval through increasing selection intensity since more individual rubber clones can be selected at the seedling stage. My research uses whole-genome marker data from GBS and phenotypic data of rubber clones to create a genomic prediction model that is used to predict the genomic estimated genetic values (GEGVs) of rubber clones in the selection population for which only genotypic data is available. With my research, selection of rubber clones to advance to next selection stages or to release as new cultivars can be done at the seedling stage, based solely on the GEGVs. Genomic selection can help meet future demands of rubber in an environmentally sustainable way and also increase the GDP in rubber producing countries and at the same time improving the livelihoods of small-scale farmers who produce 80% of the rubber in the world.



## Personal comment about the GENES opportunity

The GENES project is a fantastic and very unique opportunity for me as it has allowed me to study plant genomics which has always been my dream as a professional. The partnerships approach in the GENES project works very well as it allows collaboration with other scientists.





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## **GENES' MSc Candidate**

### **Amobi Francis OZIBO**

BSc, Applied Biology

### **Home Country**

Nigeria

### **Supervisors**

Professor Happiness Ogba Oselebe

Prof. Enoch G. Achigan-Dako

### **Crop of interest**

Bananas also referred to as *Musa* L., are perennial monocotyledonous herbs characteristically divided into dessert bananas, cooking bananas and plantains and beer bananas. It is highly nutritive and serves as source of food for man because of its high energy content. It contains all essential nutrients including vitamins and minerals. Banana is used industrially to produce insecticide, colour absorber, antioxidant, biogas, alcohol and cattle feed.

### **Research topic**

Effects of drought condition on phenotypic traits of banana assertions

### **Summary of proposal**

Bananas are quite sensitive to drought; however, genotypes with "B" genome are more tolerant to abiotic stresses than those solely based on "A" genome. Bananas with "ABB" genomes in particular are more tolerant to drought and other abiotic stresses than other genotypes. Therefore, this proposal is aimed at determining the effects of prolonged water inadequacy on the morphology of banana assertions. Bananas require frequent irrigation to avoid significant crop losses, especially during dry periods. Bananas, originally a tropical fruit crop, have reached the sub-tropics and even semi-arid regions owing to their adaptations and to growers' perseverance to manage the crop at the small expense of yield and quality. The objectives of this proposal is to assess the effect of soil moisture deficit stress on juvenile vegetative stage, floral primordial initiation (PI) stage, flowering and bunch



development on yield and yield parameters. Parameters will be taken on individual assertion of both optimal and drought condition. Stomatal conductance, cell membrane stability (CMS), leaf emergence rate, rate of leaf senescence, RWC, and bunch yield under soil moisture deficit stress are some of the traits associated with drought tolerance. Among these stress, bunch yield under drought condition will be given top priority for phenotyping.



Pictures of me growing banana

### **Personal comment**

I am highly gratified over GENES opportunity. GENES has granted me the opportunity to develop myself academically and research wise through its funding. With GENES opportunity, I can now participate abundantly in practical and researches which I would have done peripherally owing to facility inadequacy. In all, all thanks to GENES.



### **GENES' MSc Candidate**



#### **Desalegn Abebe MEKONEN**

BSc, Biotechnology

#### **Home Country**

Ethiopia

#### **Supervisor**

Prof. Barrage Moussa<sup>1</sup>

Prof. Happiness O. Oselebe<sup>2</sup>

<sup>1</sup>College of Biological and Chemical Engineering, Addis-Ababa Science and Technology University.

<sup>2</sup>Faculty of Agriculture and Natural Resources management, Ebonyi State University, Nigeria.

#### **Professional Experience**

Calibration and verification of measurement instrument and quality analysis, testing of food and chemicals in trade and transport beruea in Addis Zemen, Ethiopia. Amhara Regional Agricultural Research Institute/ARARI (Bahir Dar, Ethiopia)

#### **Crop of Interest**

Grass pea (*Lathyrussativus*L.) is a food, feed and fodder crop belonging to the family Leguminosae (Fabaceae). It is a much-branched sub erect, straggling or climbing herbaceous winter annual crop. Its reproduction system is by seed and is a self-pollinating crop. The genus *Lathyrus* has 187 species and subspecies being recognized (Wang *et al.*, 2015). It is strictly diploid with chromosome number being  $2n=14$ . Grass pea grows widely in several tropical and subtropical areas of the world. In Ethiopia Grass pea is the fifth most important pulse crop in the country and is commonly cultivated on heavy clay soils (mostly vertisols). Grass pea seeds are used in India, Ethiopia and other developing countries as part of the diet of the poor in times of famine. Seeds are used for making bread, paste balls, local beverages, utilized as boiled (*nifro*) or roasted (*kolo*), *shiro* (powdered seeds) (Urgaet *al.*, 2005).



## Research Topic

Study on Genetic diversity of Grass pea (*Lathyrussativus*L.) and Association of  $\beta$ - ODAP content of Seed in Ethiopian Genotypes with SSR Markers.

## Summary of proposal:

Grass pea (*Lathyrussativus* L.) is the source for cheap and nutritious food choice in drought and famine susceptible regions of the world. However, its use is limited and remain masked because of the presence of an endogenous neurotoxic non-protein amino acid  $\beta$ -N-oxalyl-L-  $\alpha$ ,  $\beta$ - diaminopropionic acid ( $\beta$ -ODAP). To date, only a limited number of studies have been conducted in grass pea genetic diversity study using SSR marker. The aim of this study will be to specify the  $\beta$ -ODAP content of seed and genetic variation of

Grass pea genotypes using SSR markers and clarify their phylogenic relationship in order to establish breeding programs which will be vital for the development of improved varieties of this underutilized legume crop in Africa and other parts of the world. For this, 25 grass pea accessions kindly provided by the Ethiopia Biodiversity Institute/EBI/, Ethiopia will be used. This experiment will be laid down on simple lattice design 5x5. At the end of this project, it is expected that molecular variations and similarity of Grass pea accessions will be determined, Low  $\beta$ -ODAP content genotype will be identified and Association of seed  $\beta$ -ODAP content with molecular marker will be revealed. The information generated in this study can serve as a component of effective germplasm conservation and breeding programme to improve this crop, so that farmers and other stakeholders in the grass pea value chain will benefit as a whole.



Pictures of people managing and growing Grass pea (*Lathyrussativus*.L)

## Personal comment

First of all, I would like to appreciate GENES for bringing this exciting project and the Coordinators of the project. I am delighted to be part of GENES project. The impact of the project will be irreplaceable in terms of skill, knowledge, resources and culture sharing between African brothers and it will create future collaboration in Africa. However, the fund allocated to research is very small especially for projects involving molecular studies.



### **GENES' PhD Candidate**



### **Jeremiah Sunday Nwogha**

MSc, Crop physiology

### **Home Country**

Nigeria

### **Supervisors**

Prof. Happiness O. Oselebe<sup>1</sup>

Prof. Wosene Gebreselassie<sup>2</sup>

<sup>1</sup>Faculty of Agriculture and Natural Resources Management, Ebonyi State University, Nigeria

<sup>2</sup>Faculty of Agriculture, Jimma University, Ethiopia.

### **Professional Experience:**

Staff of National root crops research institute (NRCRI)

Umudike, Nigeria Scientific Publication

### **Scientific Publication**

Jeremiah has published 4 articles in peer-reviewed Journals.

### **Crop of interest**

Yams belong to the monocotyledonous *Dioscorea* genus. This genus contains about 600 species. Approximately 10 *Dioscorea* species have been domesticated in West Africa, Asia, North and South America, Pacific and Caribbean regions. Among the *Dioscorea* cease three minor genera are obligate monoecious, while the entire *Dioscorea* genus can be facultative monoecious or dioecious depending on environment and gene interaction effects, a feature shared by few angiosperm. Yam plays an important role in food and agricultural system diversification, broadens the food base and brings food security to over 400 million people in the low income food deficit countries (LIFDC's) of the tropics and some sub-tropics. In West Africa region, yam is not just a mere food crop, it is an important cultural food crop that is



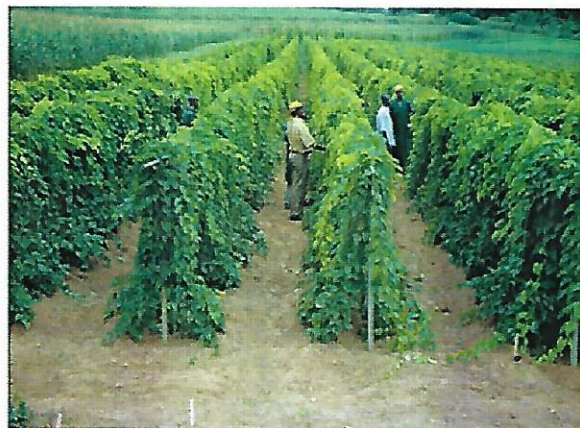
highly revered and celebrated with many festivities and is important requirement for many social functions such as; marriage, burial rituals etc. The volume of yam production among the male folks depicts social status. Industrially, yam has great potentials in the area of pharmacy, beverages and alcohol. For instance in Japan yam is already being utilised in drug and alcohol production.

### **Research Topic**

Metabolomics and transcriptomic profiling of genes implicated in tuber dormancy, initiation and bulking in white yam (*D.rotundata*)

### **Summary of Proposal:**

The high demand pressure on available yam tubers for food consumption and planting material is compounded by the long period of yam crop cycle, which spans between 8-9 months, as result of lengthy period of dormancy. This has made it impossible for yam crop to be grown more than once in a year. The mechanism(s) involve in the tuber dormancy requires complex interaction between physiology, anatomy and biochemistry, all of which are directly or indirectly under genetic control. The problem in the yam tuber dormancy is that the dormant period of the tuber is too lengthy, ranging from 30 to 270 days depending on the definition of the 'start and end of dormancy. The inability to manipulate this long period of dormancy has slowed down the pace of genetic improvement, reduced the volume of production, hikes the cost of planting materials and makes the tuber unavailable for industrial utilization. However, since there are consensus among scientists concern the start and end of tuber dormancy the study will consider whole processes of tuber development such as; tuber initiation, bulking and maturity stages. Therefore, the objectives of this study are to identify the genetic factors controlling tuber dormancy, initiation, bulking and maturity in white yam (*D. rotundata*). Metabolomics and transcriptomics profiling will be applied in identification of candidate genes controlling tuber dormancy, initiation, bulking and maturity, while RT-PCR will be used to validate novel candidates.



Pictorials of yam farmers' fields and storage barn

### **Personal comment**

GENES project is an amazing opportunity for early careers in research and academics. It offers great opportunity for academic advancement of young Africans. The project is well organised, however, there is always room for improvement.



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## **GENES' PhD Candidate**

### **Fentanesh Chekole KASSIE**

MSc, Plant Biotechnology

### **Home Country**

Ethiopia

### **Supervisors**

<sup>1</sup>Dr. Mesfin Kebede, Jimma University, Ethiopia

<sup>2</sup>Prof. Joseph Martin Bell, Dr. Hermine Bille and Dr. Joel Romaric Nguenpjo, University of Yaounde I, Cameroon.

### **Professional**

Lecturer, Wolaita Sodo University, Ethiopia.

### **Crop of interest**

Peanut, *Arachis hypogaea* L., is an important grain legume providing edible oil and protein for human nutrition. Peanut is an important oil, food and feed crop of the world. The kernels are rich in fats and protein, and 100 g of kernels provide 567 kcal of energy and 8.5 g of dietary fibre. Consumption of peanuts can reduce risk of inflammation, diabetes, cancer. Peanuts have a variety of industrial end uses. Paint, varnish, lubricating oil, leather dressings, furniture polish, insecticides and nitro-glycerine are made from peanut oil.

### **Research Topic**

Genome-wide QTL mapping of seed quality and yield-related traits in a peanut Advance Backcross population

### **Summary of proposal**

Peanut, *Arachis hypogaea* L., is an important grain legume providing edible oil and protein for human nutrition. The limited genetic diversity in cultivated gene pool has greatly hampered the application of molecular tools for breeding. However, there are wild relatives with a high level of genetic diversity. They are an important source for broadening the genetic base of cultigen and represent a great reservoir of alleles that can be used for the improvement of simple and more complex traits. To minimize the confounding effects of deleterious traits, advanced backcross (AB) quantitative trait loci (QTL) analysis was developed. An AB-QTL analysis was applied in peanuts and several QTLs with favourable alleles from the wild donor parent were identified. However, there is little effort to improve



peanut quality traits. The ultimate goal of this work is to identify QTL/genes involved in the inheritance of seed quality and yield related characters using an AB-QTL population. A set of 27 cultivated varieties, 10 wild relatives and 133 AB-QTL lines will be grown in Cameroon. A total of 38 traits related to flowering, plant and leaf architecture, pod and seed morphology, biochemistry (seed quality traits) and yield components, Genomic DNA will be extracted and genotyped, with Single Nucleotide Polymorphism.



Pictures of a farmer of the crop

### **Personal comment**

The GENES project gave very good chance to me to study plant genomics, which is very good for me because I have MSc degree related in plant genomics. In addition to getting knowledge about plant genomics GENES project opened the door to share different culture and technology.



## GENES' PhD Candidate



**Mahaman Mourtala Issa Zakari**

Mphil, Plant Breeding

### Home Country

Niger

### Supervisor:

Prof. H. O. Oselebe<sup>1</sup>

Prof. Barrage Moussa<sup>2</sup>

<sup>1</sup>Faculty of Agriculture & Natural Resources Management, Ebonyi State University, Nigeria

<sup>2</sup> Faculty of agricultural Sciences, Abdoul Moumouni University of Niamey, Niger

### Professional Experience:

Research Engineer (National Institute of Agricultural Research of Niger)

Assistant Manager, plant genetic resources National Gene bank of Niger,

National focal point of International Treaty for Plant Genetic Resources for Food and Agriculture (ITPGRFA/FAO), Niger

### Scientific Publication:

Issahas published a paper in Academic Journal of Plant Breeding and Crop Science (JPBCS).

### Crop of interest

Sweetpotato [*Ipomoea batatas* (L.) Lam] is a perennial plant cultivated as annual crop and belongs to morning glory family Convolvulaceae. It is an important tuber crop grown in more than 110 countries in the world. It is an important food, feed and vegetable crop in most tropical developing countries. The crop is ranked fifth economically after rice, wheat, maize, and cassava. The greens of the crop are edible and provide an important source of food in Africa, especially in Guinea, Sierra Leone and Liberia, as well as in East Asia. In East Africa, thousands of villages depend on sweetpotato for food security and it is called *cilera abana*, "protector of the children". In third world countries, sweet potato is processed into starch, noodles, candy, desserts, and flour, which allow the farm household to extend the availability of the crop. In some countries, the storage roots are processed to produce starch and fermented to make alcohol. In China, sweetpotato starch production has become an important cottage industry. In Japan, 20% of sweetpotato produced are used for starch



production. The juice of red sweet potato is combined with lime juice in South America to make a dye for cloth; and every shade from pink through purple to black can be obtained. The sweetpotato forage shows dry matter contents of 12 - 17% and dry matter digestibility of greater than 70%. It provides high calorie at 152 MJ ha<sup>-1</sup> day<sup>-1</sup> compared to cassava, wheat, rice and maize with respectively 121, 135, 151, and 159 MJ Ha<sup>-1</sup> day<sup>-1</sup> calories. The storage roots are rich in carbohydrate and its leaves are rich in proteins. Orange and yellow fleshed varieties are rich in Beta-carotene, a precursor of vitamin A, while purple-fleshed varieties contain anthocyanin, which is a powerful anti-oxidant and the white-fleshed is rich in dry mater. These sweet potato are being used in a number of African countries to combat the widespread Vitamin A deficiency that results in blindness and even death of 250,000-500,000 African children a year.

### Summary of proposal

More than 70% of potential yield loses in agriculture worldwide is attributed to adverse environmental factors of which water scarcity represents the most severe constraint. Drought is therefore often a major environmental constraint for sweetpotato production in areas where it is grown under rain fed condition. Development of improved, drought tolerant sweetpotato varieties will increase sweetpotato yields especially in arid and semi-arid lands where seasonal drought is a significant problem. In Niger and Nigeria, local varieties are the most used and fail to meet the demand of end-users for different utilization purposes. The main objective of the study is to develop higher yielding drought tolerant sweetpotato varieties that are acceptable by farmers and consumers in West Africa. Simple Sequence Repeat markers will be used to assess the genetic diversity and to select suitable parents. Accelerated Breeding Scheme will be the breeding method which can allow cultivar release in 3-4 years that conventional breeding cannot (7-8 years). Fifteen parents will be crossed using diallel mating design Model 1 Method 1 to develop the hybrids. The F1 progenies will be evaluated under drought stress at constrained number of location (following these steps: observational trial, preliminary yield trial and advanced yield trial). After evaluation, the best hybrids will be selected for multilocal and on-farm trials. The new hybrid varieties will then be registered in the regional catalogues of cultivated species and varieties (ECOWAS) and released to farmers. This can allow farmers to increase their production to meet their demand, earn money and process to industrial use. The Hybrid types that will be developed would provide Beta-carotene, contain anthocyanin and high dry mater.



Picture 7: Dark orange-fleshed

Picture 8: Light pink-fleshed

Picture 9: Purple-fleshed



## GENES' PhD Candidate



**Aboègnonhou Chaldia Odette AGOSSOU**

MSc, Biotechnology and Plant Breeding

### Home Country

Benin

### Supervisors

Prof. H. O. Oselebe<sup>1</sup>

Prof. Enoch Achigan-Dako<sup>2</sup>

<sup>1</sup>Faculty of Agriculture and Natural Resources Management, Ebonyi State University, Abakaliki, Nigeria.

<sup>2</sup>Faculty of Agronomic Sciences, University of AbomeyCalavi (UAC), Benin Republic.

### Professional Experience

Research Assistant at the Laboratory of Genetics, Horticulture and Seed Science (GBioS).

### Scientific Publication

Agossou has published three articles in peer-reviewed Journals.

### Crop of interest

My research focuses on *Macrotyloma geocarpum*, an orphan grain crop belonging to the Fabaceae family. This crop is a valuable one with a kg of the grains reaching up to 8 USD. It is a well consumed grain in Benin, where it is used as prestigious events food. The crop is also used in folk medicine by few communities in West Africa, included Nigeria, Togo, Ghana and Burkina Faso. Recently the crop has benefited from an increasing interest in breeding areas with focus on the seed yield and the nutritional quality improvement.

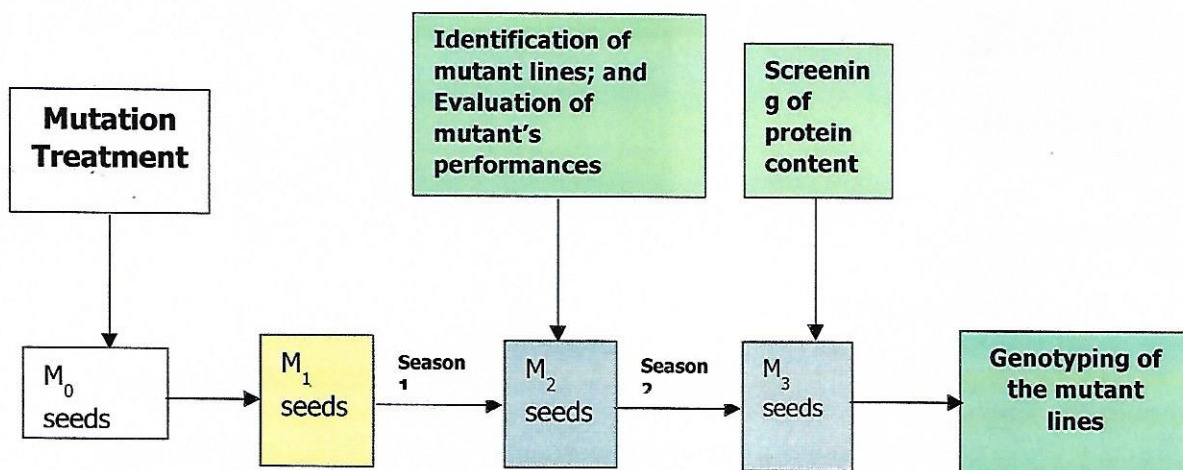


## Research topic

Yield improvement and protein variation analysis in kersting's groundnut  
[*Macrotylomegeocarpum*(Harms) Maréchal and Baudet] in West Africa.

## Summary of proposal

Most Africa countries have been facing two challenges, feeding their increasing population and overcoming the impact of climate variability. One way to contribute to increasing the food security in tropical areas, especially in Africa under the new climate change is to increase interest for breeding of some orphan crop that have the potential to easily contribute to the diets diversification and the nutritional status of local population improvement. Though legumes are an important commodity group owing to their multi-functionalities, many of the crops are still under-researched, including the kersting groundnut. Our project intends to develop improved seed yield of kersting groundnut by inducing mutation within the species; analyzing the variation in protein content within the crop and identifying SNP markers linked to this trait through genome wide association study. Our development objective is to provide farmers with high yielding and protein-dense seed. A graphical abstract of my research methods is shown below.



## Personal Comment

I am grateful to the Project Team who worked hard to bring this kind of nice project sponsored by European Union which gave me this kind of opportunity. I'm excited to be one of the scholars of this amazing program which will improve my skill and capacity in molecular breeding.



### **GENES' MSc Candidate**



**DennisOKPORIE**

B.Agric., Crop Science

#### **Home Country**

Nigeria

#### **Supervisors**

Prof Enoch Achigan-Dako<sup>1</sup>

Prof. Happiness O. Oselebe<sup>2</sup>

<sup>1</sup>Faculty of Agronomic Sciences, University of Abomey Calavi (UAC), Benin Republic.

<sup>2</sup>Faculty of Agriculture and Natural Resources Management, Ebonyi State University, Nigeria.

#### **Crop of interest**

Rice is a seed of monocot, with 24 chromosomal number  $2n=24$ , which has two major domesticated species, *O. Sativa* (the most commonly grown in Asia which originated from the river valley of Yangtze mekonrivers) and *O. Glaberimma* (popularly known as Africa rice) which has its center of origin in Delta of Niger river in Africa. NERICA is the crossing progeny of both species. It is one of the major staple food crop. It is consumed by human and livestock and services as raw materials to industries in the production of flour, infant food, livestock feed etc, and a major source income to household farmers.

#### **Research topic**

Accessing the genetic diversity among selected rice accessions using morphological and SSR markers.



## Summary of proposal

It has been expounded that identification and evaluation of high heritability in accession alone will not be enough for variety development but the combination of morphological and molecular markers will be useful in studying genetic diversity of rice for conservation, breeding and other crop improvement activities. However, this study will aim at accessing the genetic diversity among selected rice accessions using morphological data and SSR markers in order to identify high yielders with superior quality traits and diverse adaptability, for use as parents in a breeding program. The breeding tools to be applied include the use of morphological characterization and SSR markers, with a molecular breeding method. This will be conducted in a simple lattice design experiment. Moreover, it is expected at the end of this research that genotypes of superior genetic quality with high adaptive mechanism to our environment would be identified among the selected rice accessions and would be subjected to further improvement which will help in combating food insecurity in Africa and globally.

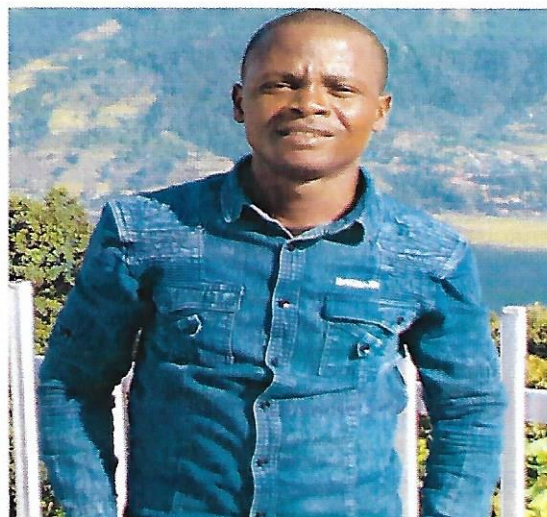


## Personal comment

The gene opportunity has widened my scope in the area of becoming a renowned plant breeding researcher and a clear understanding about the need of molecular breeding in this contemporary society. It has enhanced my rational ability and focus in offering solution to the present need in agriculture.



## **GENES' PhD Candidate**



### **Hervé DEGBEY**

MSc, Plant Genetic Resources Conservation and Crop Protection

### **Home country**

Benin

### **Supervisors**

Prof. H. O. Oselebe<sup>1</sup>

Prof. Enoch G. Achigan-Dako<sup>2</sup>

<sup>1</sup> Faculty of Agriculture & Natural Resources Management, Ebonyi State University, Nigeria

<sup>2</sup> Faculty of Agronomic Sciences, University of Abomey Calavi (UAC) Benin

### **Professional Experience**

Research Assistant at Faculty of Agronomic Sciences, University of Abomey Calavi (UAC) Benin.

### **Scientific Publication**

Herve Degbey has published one article in Scientific African and has one under review in *Molecular ecology*.

### **Crop of interest**

Banana and plantain (*Musa* spp.) are among the most important crops worldwide (Droc et al., 2013). They are cultivated in more than 130 countries across the world (Sardos et al., 2016) and the fruits are rich in potassium, calcium, manganese, carotenoid and vitamin and are used for human nutrition (Adesoye et al., 2012; Englberger et al., 2006) and animal feeding in developing countries (Adesoye et al., 2012). The plant also provide biomass of sugar, cellulose and starch for industrial uses in developed countries (Droc et al., 2013). A ripened banana contains 70% of water and 27% digestible.



## Summary of proposal

Banana Bunchy Top Disease (BBTD) is a severe disease that thoroughly affects banana production under tropic and sub-tropic regions across the world (Stainton et al., 2015). It is the most destructive banana viral diseases, causing up to 100% of yield destruction worldwide (Dale 1987, Kumar, et al., 2015). The disease is caused by Banana Bunchy Top Virus (BBTV), a complex of banana streak viruses (BSVs) and Banana bract mosaic virus (BBrMV) (Dale, 1986; Magee, 1927) which is the most invader virus within the genus of *Babuvirus* in the family of *Nanoviridae* (Dale, 1987, Kumara et al., 2011). Recently, Kumara et al. (2011) reported that the virus has reached Central Africa including DRC, Angola, Cameroon, Gabon and Malawi. It has become very invasive and has reached West-Africa and specifically reported in Benin in Ouémé department (6°30'N and 2°36'E) in 2011 (Lokossou et al., 2012). In Nigeria the disease has been for the first time reported in Ogun State in 2012 by Adegbola et al. (2013). The general objective of the study is to contribute to reducing the propagation of BBTD in banana and plantain production system in West-Africa. The specific objectives include: (a) assess the genetic structure and the population differentiation among *Musa* genotypes grown in West-Africa, (b) conduct diagnostic field-assays for screening of BBTV among the non-redundant cultivars of *Musa* grown in West-Africa, (c) Develop the cost-effective and affordable SSR primer sets for BBTV streams identification with endogenous counterpart.



During suckers collection at Ekpatala village in Ikom Local Government Area of River state, Nigeria, in February 2019



## **GENES'MSc Candidate**

### **Hailu Lire WACHAMO**

BSc, Plant Science

### **Home Country**

Ethiopia

### **Supervisors**

Prof. Enock Achigan-Dako<sup>1</sup>

Dr. Wosene Gebreselassie<sup>2</sup>

Dr. Temesgen Magulo<sup>2</sup>

<sup>1</sup>Faculty of Agronomic Sciences, University of Abomey Calavi (UAC), Benin Republic

<sup>2</sup>Faculty of Agriculture, Jimma University, Ethiopia

### **Professional Experience:**

Researcher in Ethiopian Institute of Agricultural Research under crop research process.

### **Scientific Publication**

Hailu has published 4 (four) journal articles.

### **Crop of interest**

Roselle/Karkade (*Hibiscus sabdarifa* L.) is an annual plant in the family of Malvaceae grown in the tropics and subtropics (Wilson, 1994). It is an important economic, medicinal and pharmaceutical plant mainly cultivated for its calyx (sepal), which is of three types: green, red and dark-red. Its seeds, leaves, and roots are also economic importance. It is used to treat hypertension, pyrexia and liver damage, against leukemia due to its high content in polyphenols, particularly protocatechuic acid and in Ayurvedic medicine. Fleshy red calyxes (sepal) of Roselle are commonly used for the production of soft drinks and tonic without alcohol like wine, juice, jam, jelly, syrup and also dried and brewed into tea and spice. In Africa it is a popular beverage drink like Zobo in Nigeria and bissap in francophone West African countries; and karkade tea in East Africa (Ethiopia, Egypt, Kenya, Sudan and South Sudan). Its demand steadily increased over the past decades. Currently, approximately 15,000 metric tons enter into international trade each year and; Germany and America are the main importing country in the world.



## Summary of proposal

Roselle has nutritional and health importance, it also has an achievable economic value and important role in income generation and subsistence for rural farmers in developing countries (Atta, 2011). But it has been received little attention in Africa; its yield affected by various biotic and abiotic factors and little is known regarding to germplasm collection, characterization, genetic variability study for its yield and yield related trait improvement as well as post harvest handling. This is supposed to be large when considering its wide geographical distribution. Its calyx (sepal) yield improvement requires consideration of all traits in its breeding programs and knowledge of associations between all the traits are essential to determine the most efficient breeding procedure and leads to the choice of elite lines. For using available genetic resource in the continent characterization is relevant for the further improvement program. With these rationales mainly the study focused on morphological and molecular characterization of roselle (*Hibiscus sabdariffa* L.) accessions from East and West Africa. To provide an initial information complemented by molecular techniques for its further genetic improvement which address targeted commercial trait and breeders to make better decisions when choosing the germplasm used in breeding programs.



Pictures of the crop and picture of me managing the genetic resources.

## Personal comment

I am glad to be a scholar of the Intra Africa Academic Mobility GENES project. Because of this opportunity, I got a chance to study molecular and morphological characterization from a regional collection on economically important leafy vegetable and medicinal but under-researched Roselle crop to increase its production and productivity for steadily increasing demand and emerging industry.



## **GENES' PhD Candidate**

### **Chikezie Onuora ENE**

MSc, Plant Breeding and Genetics

### **Home Country**

Nigeria

### **Supervisor**

Prof. Wosene Gebreselassie Abtew<sup>1</sup>

Prof. Happiness O. Oselebe<sup>2</sup>

### **Professional Experience**

Assistant Lecturer, Alex Ekwueme-Federal University Ndufu-Alike, Abakaliki, Ebonyi State, Nigeria

### **Scientific Publication**

Chikezie has published 5 articles in peer-review journals.

### **Crop of Interest**

Tomato (*Solanum lycopersicum* L.). Tomato is the second most consumed vegetable after potato in the world. Tomato fruit has an important place in the human diet as it contains the antioxidant lycopene, vitamins A and C,  $\beta$  - carotene and phenolic compounds. The world production and consumption of both fresh market and processed tomatoes (e.g. ketchup and paste) has grown rapidly over the past 25years. It is worth a tremendous amount of money because of its high yield and has international recognition in the world market; and short duration in field which permits quick turnover in yield, which results in their high economic value. It is a popular choice by people who wish to grow it in their own gardens both for their own use and local market. Total world production is 152.9 million tons with a value at \$74.1 billion (FAOSTAT Database, 2009). USA alone produces 14.1 million tons per annum with a value at \$10.86 billion (USDA, 2010). Nigeria contributes only 2% of total world tomato production. In Nigeria, the highest yield of tomato in history was recorded in 2010 which was 1.9 million tons value at \$687, 610,000. Yet, it's not sufficient as the national demand for fresh tomato in Nigeria is about 2-3 million tons annually. Due to poor production chain and post harvest losses, Nigeria wastes about 750,000-1,350,000 tons about 45-65% of the annual production value at \$380, 450,000 (Ibenegbu, 2017).



## Research Topic

### Summary of proposal:

Tomato production is an economically important venture in Africa, but is not profitably produced in the humid zones due to excessive precipitation and the associated high relative humidity diseases. Breeding of tomato cultivars that are high yielding with acceptable market fruit size and some level of tolerance to high humidity conditions will open up a new production opportunity for the poor resources farmers in the rain forest ecologies. An increase in the tomato growing areas will minimize the need for long distance transportation of tomato from the drier parts to the more humid regions. This will reduce the transport induced damage or deterioration and the subsequent reduction of the market price of tomato fruits. The expansion of the production areas would also create additional employment in the sector and generate income. Increased production at a reduced cost would also benefit the industrial sector especially those making tomato based products because of increased availability of raw materials for processing. These benefits can be achieved if home-based cultivars with adequate adaptation to the humid environments are developed through organized breeding preferably interspecific hybridization as breeding method followed by good selection processes subsequently. Single Nucleotide Polymorphisms (SNPs) markers of the quantitative trait loci (QTL) underlying fruit size and shelf-life in tomato would be performed. There are about six major tomato fruit size QTL of which their combination and order of magnitude would help determine the level of success in the improvement of fruit size in tomatoes during selection. Selection process that is able to assemble the six major QTLs for fruit size in a single population would produce large fruited tomato variety. Fruit size is quantitatively inherited and large members of QTLs have been identified in tomatoes that are associated with fruit development, size, shape, colour, ripening, organoleptic quality and yield. The objectives of the present study are therefore: (1) to identify the major developmental pathway for large fruit size in tomato as ordered by the relevant loci, using crosses between the large fruited tomato variety and the interspecific hybrids (derived from initial interspecific hybridization), (2) to establish the number, magnitude of effects and the interaction of the QTL in the determination of fruit size and firmness (increased shelf-life), and (3) to identify and select acceptable market fruit size tomato variety with excellent adaptation to high humidity conditions of south eastern Nigeria.



Pictures of myself Managing the Genetic Resources Picture people growing the crop

### Personal Comment

GENES opportunity has made my dream of being trained in plant molecular breeding a reality. More grease to the elbow of the project initiator(s).



## **GENES' MSc Candidate**

### **Noel NDLOVU**

BSc, Crop Science

### **Home University**

Zimbabwe

### **Supervisors**

Prof. W. Gebreselassie<sup>1</sup>

Dr. E. Gasura and Dr. S. Dari<sup>2</sup>

<sup>1</sup>Jimma University

<sup>2</sup>University of Zimbabwe

### **Crop of interest**

Africa Yam Bean (*Sphenostylis stenocarpa* (Hochst. Ex A. Rich.) Harms) is a tropical leguminous crop that serves the triple purpose of providing edible seed grain, tuber and leaf spinach. It is one of the classified under-utilized or orphan crop species with unlimited potential in ameliorating the food and nutritional insecurities facing Africa in the wake of climate change its associated effects. The seed grain component of the crop contains >20% protein rendering it an inexpensive protein source for the resource-poor communities. Furthermore, Africa Yam Bean has medicinal properties in the management of hypertension, diabetes and cardio vascular diseases.

### **Research Topic**

Morphological characterization and genetic diversity assessment of African Yam Bean (*Sphenostylis stenocarpa* (Hochst. Ex A. Rich.) Harms) Accessions in Ethiopia

### **Summary of proposal**

The recurrence of drought and prevalence of malnutrition incidences in African small-holder farmer communities have raised the need for exploiting the potential of orphan or under-utilized crop species. Africa Yam Bean (AYB) possesses a greater potential in providing an inexpensive and sustainable solution to the aforementioned challenges. AYB accession management and planning for genetic resource capacity maximization has not been fully established. Furthermore, limited strides have been made in establishing the existing genetic diversity and the possibility of improvement of the studied accessions. The lack of background information on the crop is hindering its sustainable development. Consequently, this has led to a limited source of genetic resources conferring high yield and other favourable agronomic traits. The main objective of the study is to determine the extent of



genetic diversity and inter-relationships between yield and associated traits among the collected AYB accessions for utilization in future breeding and germplasm conservation. The study is expected to open a new wave of understanding on genetic diversity among the AYB accessions which is vital in germplasm conservation and future breeding programmes.



Picture of me and the crop



Picture of the crop grower

### **Personal Comment**

The research mobility provides an ideal platform with the capacity to catapult African agriculture towards prosperity. However, it will be of greater value if cooperation with experienced private entities in the various specialties of crop improvement is incorporated to foster growth of all student beneficiaries of the programme.



## GENES' MSc Candidate

### Chukwunyere Ebube Oliver

BSc, Biological Sciences

### Home country

Nigeria

### Supervisor:

Dr. Wosene, G.<sup>1</sup>

Prof. Okezie, C., and Dr. Ofodile L. N.<sup>2</sup>

<sup>1</sup>Jimma University, Ethiopia

<sup>2</sup>Chukwuemeka Odumegwu Ojukwu University (former Anambra State University), Nigeria.

### Crop of interest

Lima bean is the second most important legume in the world of the genus *Phaseolus*. A herbaceous species which includes both annual determinate bush types and perennial indeterminate climbing types, perennial due to the presence of large swollen tap roots. The bush types are short, about 0.6 m tall, whereas the climbing types are up to about 25 m. Each plant on maturity produces a large number of pods. Each pod is oblong, often curved and terminates in a sharp beak facing the dorsal suture. Pods contain two to four seeds and dehisce on drying. Seeds may be small, medium or large-sized depending on the lima bean type. Seed weight varies from about 0.5 g/seed in the small-seeded types to as much as 3-4 g per seed in the large-seeded types. Seed shape may range from kidney, through rhomboid to round. Seed colour is variable and may be speckled, mottled, or full-coloured. Colours vary and usually include white, grey, yellow, brown, purple or black. Wild varieties usually have small pods, are small-seeded, seed colours being predominantly grey, black or speckled. Economic and industrial Importance includes, a) its intake can lowers LDL cholesterol levels, b) they have anticancer benefit because of it phytochemicals coumestrol and saponins, compounds contents, c) nitrogen-fixating legume that sheds its leaves profusely therefore can be used for soil fertility restorer, d) its forage can be fodder used in making silage and hay for animal feeding or diet supplements, and it is used as a food and an alternative income source for the local population.



## Topic

Variability study for yield and quality traits in Lima bean (*Phaseolus lunatus*) using morphological and nutritional parameters.

## Summary of proposal

Lima bean, *Phaseolus lunatus* is a member of the family leguminosae. It is an easy to grow grain legume and of a high food value and many health benefits with a protein content ranging from 17 to 40 g/100 g, quite higher than that in cereals (7-11.8 g/100g) and approximately equal to the protein content of meat 18-25 g/100 g. Its fat content is low as it also contains carbohydrate (sugar and starches), vitamin and minerals (calcium, iron, phosphorus, and potassium). The development of strategies for genetic breeding and for *in situ* and *ex situ* seed conservation is important. The genotypes maintain several undesirable traits, including pest and disease susceptibility, indeterminate growth, long life cycle, and high hydrocyanic acid content, among others, they also have good local adaptation and a large amount of genetic variability. More also, in the developing world, protein energy malnutrition is a major challenge and it is quite difficult to provide adequately, animal protein supplies needed by consumers without incurring high cost. Therefore, main objective of this work will be to carry out the variability study for yield and quality traits in Lima bean (*Phaseolus lunatus*) using morphological and nutritional parameters. Data will be collected for the proximate, mineral and anti-nutrients contents in the raw, cooked, roasted, germinated and fermented lima bean samples. As we expect, the result of this study may qualify Lima Bean for use in making flour and used in many other food preparations such as baby foods and baked products. The crop has been observed to have high yield potential, deep root system and drought tolerant, making it a good prospect crop in tropical Africa.



Sample of Lima Bean Cultivar to be planted



## **GENES' MSc Candidate**

### **Miss Catherine Ifekwe**

B.Agric, Crop Science

### **Home Country**

Nigeria

### **Supervisor:**

Prof. Enoch G. Achigan-Dako<sup>1</sup>

Prof. Happiness O. Oselebe<sup>2</sup>

<sup>1</sup>Faculty of Agronomic Sciences, University of Abomey Calavi (UAC) Benin

<sup>2</sup>Faculty of Agriculture & Natural Resources Management, Ebonyi State University, Nigeria

### **Crop of interest**

Fonio *Digitaria exilis* Kippis Stapf. and *Digitaria iburua* Kippis Stapf is one of the oldest domesticated cereals in West Africa as far as 2400BC (Larson et al. 2014). Fonio has important potential not only as survival food, but as a complement for standard diets and source of income. It is a brewer's grain for beer brewing and can be ground into flour for preparation of local beverages. More than 710,000ha of fonio are grown each year in West Africa and the production runs at 620,000t (average yield 870kg/ha). Fonio feeds millions of people during the most difficult months of the year.

Topic: **Agro-phenological characterization fonio accessions  
(*Digitaria* spp.) grown in northern Nigeria**

### **Summary of proposal:**

Despite the importance in traditional agriculture, research efforts to improve fonio millets are still at a low level. In consequence, the crops remain primitive facing



diverse agronomical and technological problems. Fonio cultivation relies only on traditional landraces which are, despite their adaptability to marginal farming system, less productive. Therefore, the objectives of the present study is; To evaluate the genetic variations among the fonio germplasm collected from Northern Nigeria in order to identify varieties with unique traits for possible recommendation.

The specific objectives of the study are to; a) collect and document fonio accessions and related farmers knowledge in five Northern State of Nigeria, b) investigate the phenological diversity among the collected fonio accessions using fonio descriptor, and c) assess the morphological relatedness of the cultivated indigenous fonio accessions. Add pictures of people growing your crop, or using it. Or pictures of yourself managing the genetic resources.



Weeding in Fonio cultivated area