GENETIC IMPROVEMENT OF BETA-CAROTENE, YIELD AND STORABILITY IN SWEET POTATO (*IPOMOEA BATATAS*) CONRTOLLED-CROSSES IN UGANDA

Astere BARARYENYA
PhD Student, Plant Breeding and Biotechnology
Student Reg: 2015/HD02/2921X

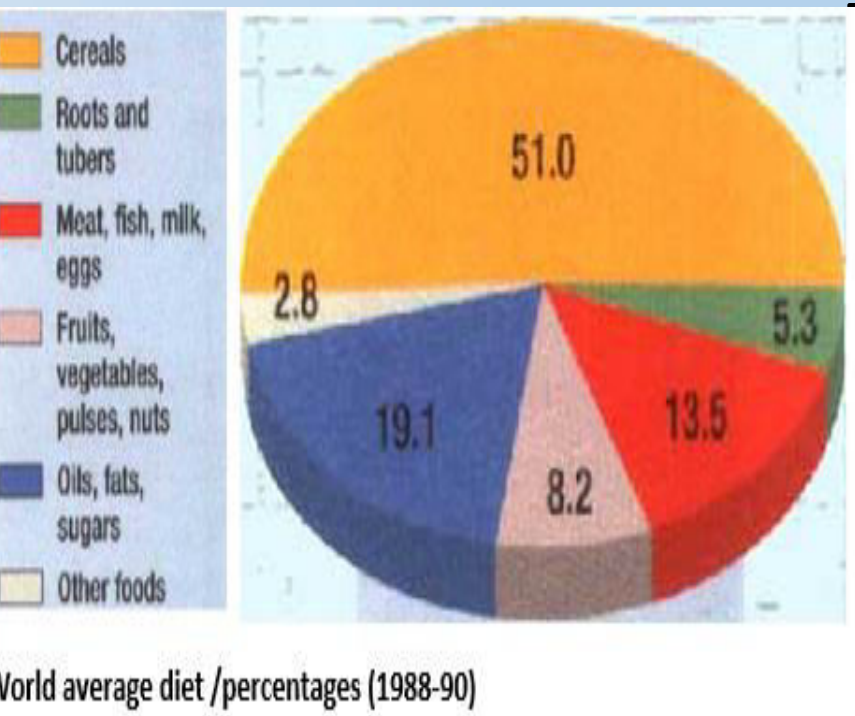
Supervisor: Ass. Prof. Pheneas Tukamuhabwa, PhD
Makerere University, Uganda.
P.O. Box 7062Kampala

Co-supervisors:

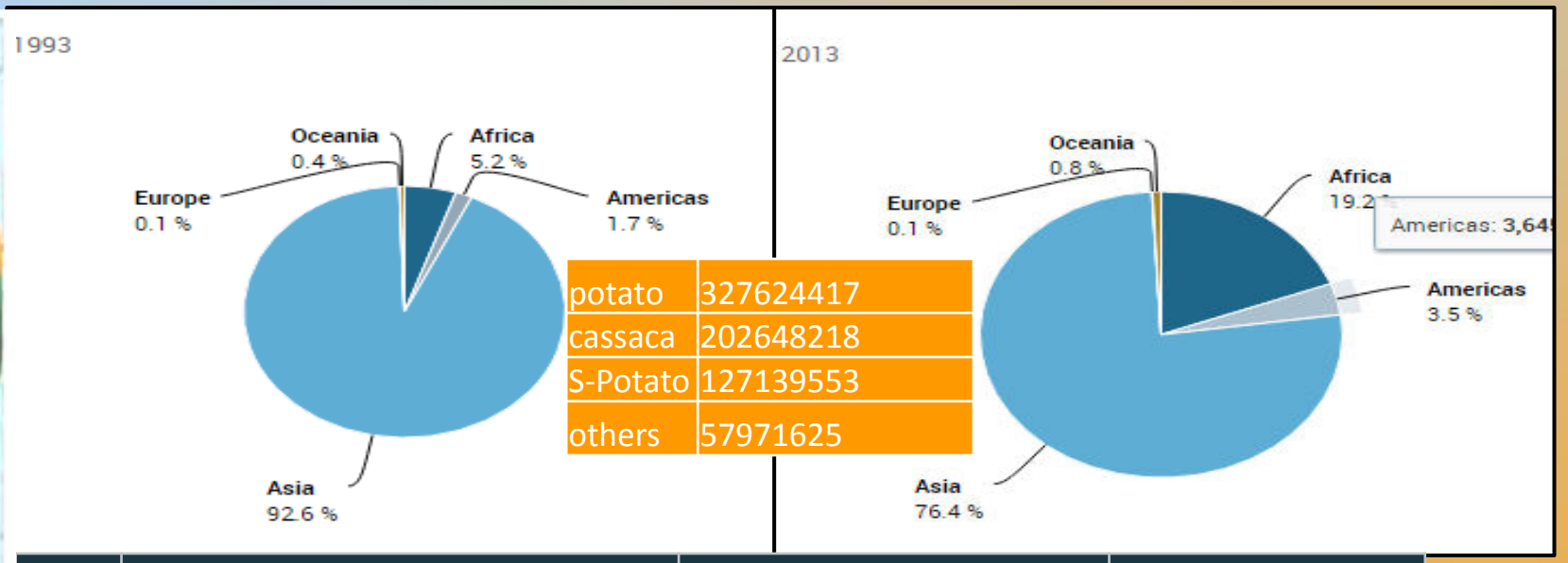
Dr. Wolfgang Grüneberg, PhD
CIP, LIMA, PERU

Dr. Robert Mwanga, PhD
CIP, Sub-Sahara Africa
PO Box 22274, Kampala, Uganda

1.Sweetpotato (*Ipomea batatas,L.*) global importance status



World average diet /percentages (1988-90)



potato	327624417
cassaca	202648218
S-Potato	127139553
others	57971625

last 20 years SP:

- ✓ Remain constant in Europ,
- ✓ Increased more than 3 times in Africa,
- ✓ Increased 3 times in America'
- ✓ Reduced in Asia

Rank	Country	Production (Int $1000)	Production (MT)
1	China, mainland	2,680,488	77,375,000
2	Nigeria	256,795	3,400,000
3	Uganda	200,149	2,645,700
4	Indonesia	167,139	2,483,467
5	United Republic of Tanzania	152,428	3,018,175
6	Viet Nam	96,694	1,422,501
7	Ethiopia	89,504	1,185,050
8	United States of America	83,279	1,201,203
9	India	83,080	1,072,800

http://www.mapsofworld.com/world-top-ten/sweet-potato-producing-countries.html, last update February 201

2. Problem statement

- World population will reach up to 9 billions by 2050
- Agriculture has to be more productive to face current and new coming challenges
- Food security and nutrition are major issues which demand rapid plant breeding responses
- SP remains a subsistence crop in most of African countries
- Thus grown and consumed by most poor people categories that are highly nutritional deficient
- In that case, β-carotene content varieties are likely to impact on that vulnerable group

3. Justification

- Until 2015, 22 cultivars were released in Uganda
- However, many farmers still prefer traditional cultivars
- Breeding programmes need evaluation to review progress of genetic advances
- Hetorosis phenomenon has been proved in Sweetpotato breeding on yield, however it is not well known for other quantitative and qualitative traits like β-carotene content,
- Determining and Understanding the hetorosis and other component of gene action in sweetpotato could enhance breeding efficiency of the crop.

Overall objective:

To contribute to the Sweet potato population development to produce efficiently superior varieties to overcome to producer and farmers need for food and nutritional security in Uganda.

Specific objectives:

1. To determine the relationship between phenotypic and genotypic characteristics among selected sweetpotato cultivars in Ugandan germoplasm
2. To investigate the inheritance of $_{\beta}$-carotene content in sweetpotato
3. To identify the yield performance of selected new developed sweetpotato clones across different environments

6. Methodology

Study 1: To determine the relationship between phenotypic and genotypic characteristics among selected sweetpotato cultivars in Ugandan germoplasm

Plant materials

- 7 Orange fleshed varieties, selected for their high beta carotene content, 7 old cultivars (1990s), other 4 popular varieties (as check)

Phenotyping: Under fields trials

Experimental design: RCBD, *3 sites, 3 replications, 2 seasons*

Data collection: Morphological data following CIP descriptors (Huaman, 1991) , yield data (root, vines), dry matter and B carotene content

Genotyping: Molecular analysis under lab

- **Approach: leaves will be sampled, DNA extracted, Genomic DNA isolated and analyzed with SSR markers.**
- **Data analysis**

Field data: ANOVA, principle component analysis, cluster analysis

Genotype data: Similarity matrix will be analysed using Jaccard's coefficient and dendrogram will be generated

Study 2: Investigation of the inheritance of β-carotene content in sweetpotato

.

Planting materials: 7 parents (2 females and 5 males)

Mating design: NC II

Crossing block establishment, crosses, seed harvesting, seedlings nursery establishment, vines multiplication

Field trial: 3 sites, 1 season, alpha lattice, 2 replications

Data collection: Morphological data following CIP descriptors (Huaman, 1991) , diseases data, yield data (root, vines), dry matter and B carotene content

Data analysis: ANOVA, GCA and SCA, heritability, gene actions, heterosis.

Study 3: Identification of yield performance of selected new developed sweetpotato clones across different environments

Planting materials: At least 30 new clones will be selected

Field trial: 3 sites, 2 season, RCBD, 3 replications

Data collection: Diseases data, yield data (root, vines), dry matter and B carotene content

Data analysis: ANOVA, AMMI

work plan

Activities	Year 1				Year 2				Year 3			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
PhD course work												
Study 1: To determine the relationship between phenotypic and genotypic												
First field trial												
Second field trial												
Genotyping												
Study 2: To investigate the inheritance of beta carotene content in												
Establishment of crossing block												
Cossing												
Seed harvesting												
Seedling nursery establishment												
Vine multiplication												
Study3.To identify the yield performance of selected new developed												
First field trial												
Second field trial												
Thesis writing												

Coming in: Sweetpotato work in Burundi

Objective. To develop high yielding and diseases resistant's OFSP varieties to enhance food security and nutrition in Burundi.

Undergoing and planned activities

- ❑selecting disease free planting material
- ❑ introduction of OFSP from Muguga-quaranteen station in Kenya
- ❑ setting up a germoplasm evaluation trial to select best crossing parents
- ❑ establish a crossing block at Moso research station (1100 m asl)

Molecular characterization of sweet potato landraces and cultivars grown in Burundi

Objective 1: To document sweet potato germoplasm in Burundi

Objective 2: To describe and characterize genotypically and phenotypically sweet potato landraces and other cultivars currently grown in Burundi;

Objective 3: To study genetic diversity of local sweet potato landraces and others cultivars grown in Burundi.

Objective 4: To establish sweet potato core collection at ISABU

Thank you for your attention