



ADAPTATION AND GENETIC ANALYSIS FOR EARLINESS AND YIELD OF YAM BEAN (*PACHYRHIZUS SPP*) IN RWANDA

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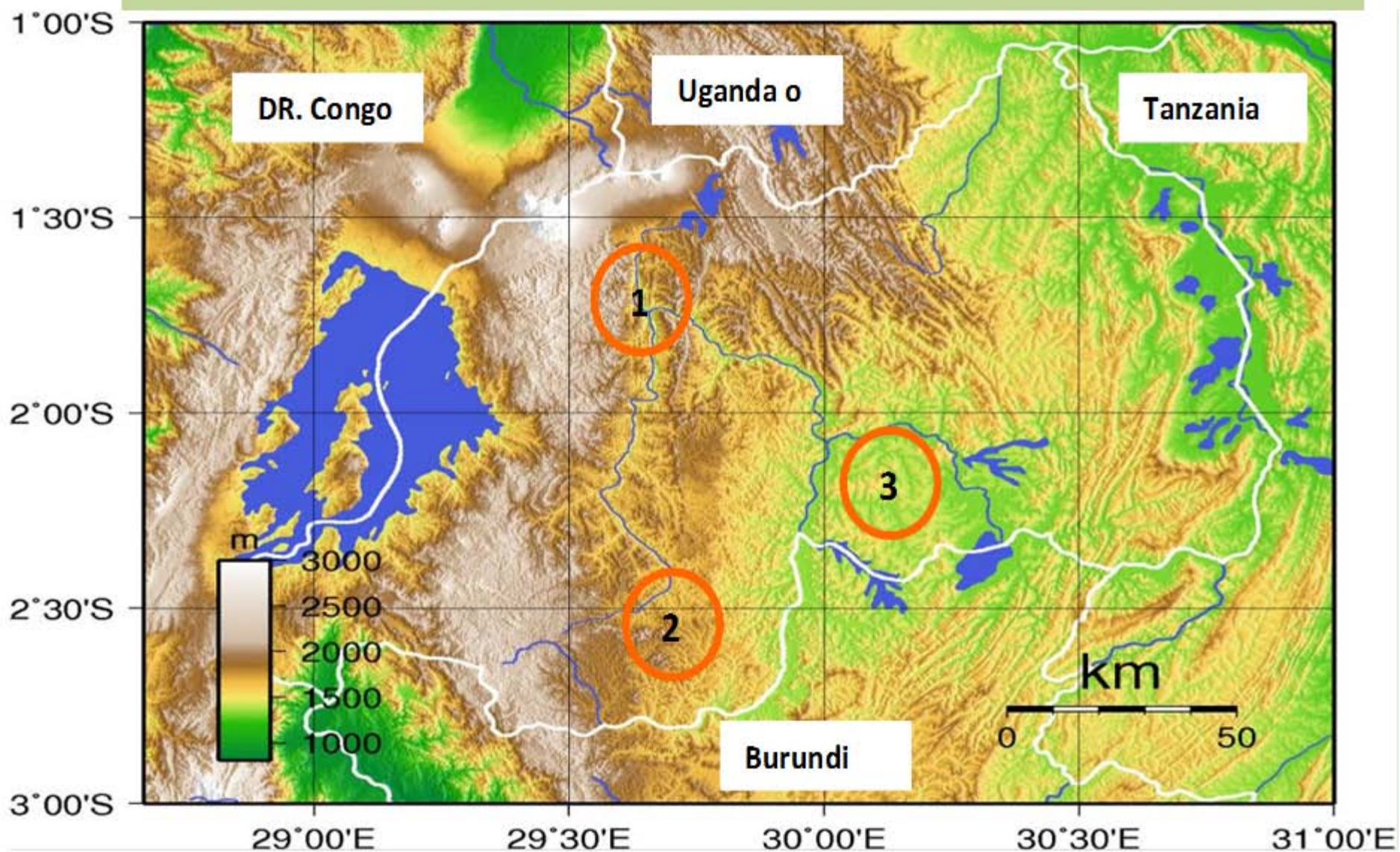
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Multilocation trials

- is to assess introduced YB accessions (***Ahipa, Erosus and Tuberosus***) for adaptation to major agro-ecological zones best desirable traits such as yield, dry matter, and tolerance to diseases and with high nutritional value

Sites selection



Yield performance of 9 YB accessions in 2
locations of Rwanda

Material and Sites selection

- **9 accessions (*P. ahipa*)**
- **3 sites (Karama, Rubona, and Musanze research stations)**
 - **Karama:** 02°17.18S, 030°15.49E, Altitude: 1457m
 - **Rubona:** 2°29.01 and 29° 46.34E, Altitude: 1650m
 - **Musanze:** 1° 28' 60 S, 29° 37' 0 E, Altitude: 1843m

The 3 locations are characterized by bimodal rainy seasons per year

Material and methods

- **Traits:** Fresh storage root and dry matter yield,.
- **Harvested:** 150-210 days after plantation (DAP).
- Diseases symptoms after one month planting recorded
- Data was analyzed and summarized using Genstat 6.0

Means of 3 parameters in performance evaluation of 9 YB varieties in Rwanda during 2 seasons at 2 locations

Accessions	Storage root fresh in 2012A(t/ha) Rubona	Storage root fresh in 2012B (t/ha) Karama	Storage root DM (%)	HI (%)
209003	5.41	13.50	20.84	69.72
209006	5.13	34.48	17.49	61.07
209018	73.19	111.33	17.97	53.13
209019	55.96	108.00	19.15	62.80
209032	12.37	27.55	17.55	62.50
209033	9.67	38.28	18.29	65.57
209034	3.74	26.42	16.45	66.52
209035	8.74	26.25	16.55	59.70
209029	9.63	30.25	19.58	57.49
Grand mean	10.43	51.34	16.73	62.05
L.S.D (5%)	12.98	17.25	0.25	3.71

YB trial and roots



MYT at Rubona 2012A

Performance of 10 accessions in two locations (Musanze and Rubona) during season 2012A

Varieties	Storage root fresh in 2012A (t/ha) Musanze	Storage root fresh in 2012A (t/ha) Rubona
209003	0.09	8.33
209004	0.08	5.65
209006	0.16	7.69
209007	0.04	1.40
209016	0.05	11.75
209017	0.04	4.60
209018	0.84	30.93
209019	0.25	30.00
209050	0.19	3.65
209060	0.00	12.87
Grand mean	0.06	8.16
L.S.D (5%)	0.032	5.24

Determination of genetic inheritance of earliness and its components in yam bean

Study 2:

Materials and methods

- Location: **Rubona** (see study 2)
 - Six yam bean accessions comprising of
 - **3 *P. ahipa***: -209023
-209028
-209031
 - **3 *P. tuberosus***
-209013
-209014
-209015
- Parents characterized early maturity (**5 months**) with moderate yields (**12T/ha**)
- Parents characterized late maturity (**8 months**) with maturity with high yields (**30T/ha**)

Introduction

- **Yam bean** (*Pachyrhizus sp*) is within the legume family with edible tuberous roots (Fabaceae)(Sørensen 1988).
- It has been recognized and recommended as important source of human nutrition (FAO,1979)
- YB contains **3** closely related cultivated species:
P. tuberosus, *P. erosus* and *P. ahipa*
- YB produces heavy storage roots (up to 145 t/ha) with up to 24% dry matter (DM).
- Unlike other root crops, YB storage roots are richer in protein (18%) and micro minerals (Fe, Zn and Ca).

Materials and methods

- **9** cross combinations with no reciprocal to generate progenies (F1 seeds)

AC209004 x TC 209013

AC209004 x TC 209014

AC209004 x TC 209015

(Hyb.1, Hyb2 &Hyb.3)

AC209022 x TC 209013

AC209022 x TC 209014

AC209022 x TC 209015

(Hyb.4, Hyb.5 &Hyb.6)

AC209031 x TC 209013

AC209031 x TC 209014

AC209031 x TC 209015

(Hyb.7, Hyb.8 &Hyb.9)

Material and methods cont'd

- **Design:** RCBD with **single rows** plot, spaced at 1 meter apart planted with 6 seeds spaced at 0.30 m within rows/ **without pruning**
- **Treatments:** 6 parents and hybrids
- **Season :** 2012 second rains
- **Management:** Plots are kept free of weeds by routine weeding
- No chemical fertilizers or pesticides are applied

Data to be recorded

- Observations will be recorded on plants in each replication for **quantitative traits** including:
 - ✓ **days to emergence (DE),**
 - ✓ **Days to first flower/ Days to 50% flowering**
 - ✓ **days to maturity,**
 - ✓ **grain yield per plant,**
 - ✓ **storage roots yield ,**
 - ✓ **plant height,**
 - ✓ **number of pods per plant,**
 - ✓ **pod length,**
 - ✓ **number of clusters per plant,**
 - ✓ **and 100 Seed weight.**

Data analysis

- Harvesting of roots will be done when plants are physiological mature
- Number of roots (NR) and Storage roots yield (SRY) will also be recorded
- Recorded data will be subjected to ANOVA as outlined by North Carolina II design using GenStat statistical software version 12 to observe level of significance of F2 hybrids and their parents.
- Analysis of general (GCA) and specific (SCA) combining ability will be performed and their respective mean squares will give GCA: SCA ratios (Hausmann *et al.*, 1999; Da Silva, 2008).

Data analysis

- Genotypic Coefficient of Variance (GCV), Phenotypic Coefficient of Variance (PCV) and narrow sense heritability h^2 for all phenotypic traits will be estimated based on mid parent offspring regression (Snedecor and Cochran 1980)

$$\hat{g}_i = \bar{y} + b(x_i - \bar{x}) \quad \text{and} \quad b = \frac{\text{cov}(xy)}{\text{var}(x)} = \sigma_{y/x}^2 / \sigma_x^2$$

PCA and cluster analysis will be used to examine the inter- and intra-specific differences between the species and accessions.

Preliminary results



Rubona station



Karama station



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THANKS

Introduction cont'd

- YB roots are always eaten raw and there are no reports on anti-nutritional factors (**Grüneberg, 2009** **Sørensen, 1996**)
- Yam bean can be processed in gari ,flour, can be used in wheat flour based products (**Wassens, 2011**)
- Success introduction of improved YB cultivars has been made in traditional cropping systems and field conditions (Mexico, Central America, South East Asia and West African countries)(**Zanklan, 2003**).

Background and Justification

- Food and nutrition insecurity attributed to the decreasing productivity of major root and tuber crops [potato, cassava and sweetpotato]
 - Poor soil fertility
 - Pests
- Major root and tuber crops are late maturing crops (problem of crop rotation)
- Rwanda agriculture is characterized by a narrow or scope of root crops
- Rwanda is characterized by diets based on cereals and tuber crops which are poor

Background and Justification

- 22% of Households/ 2.2 millions are malnourished
- Lack of alternative high yielding crop with early maturity to fit into Rwanda cropping system
- No information on roots yield performance of introduced Yam bean:
 - Adaptation
 - Genetics
- No information of genes which control the maturity in yam bean

Background and Justification con't

- **No proof of concept that YB can lead to greater food availability and improve food quality**
- **Lack of alternative early maturing and high yielding crop which fit to Rwanda cropping system /land scarcity**
- **Knowledge gap on genetics and phenotypic plasticity or variability of the 3 introduced YB species**
- **No research of inheritance for earliness and root yield of Yam bean progenies**
- **YB is nitrogen fixing**

Objective in Rwanda

- The overall objective of the study is to establish the stability of root yield and collect the pre-breeding information on gene action for earliness and heritability of roots yield of yam bean

Specific objectives

- 1. Evaluate YB accessions for adaptation to different agro-ecological zones in Rwanda**
- 2. Determine inheritance of earliness and its components in Yam bean**
- 3. Determine heritability of root yield and its components in Yam bean**

Adaptation of introduced yam bean accessions in Rwanda