

# **Improving cassava yields in Africa in drought prone environments**



# Outline

- Rationale
- Project activities
- Outputs
- Challenges
- Partners
- Impact

# Rationale

- ❖ Cassava is an important crop for food security for millions in Africa
- ❖ A greater part of the cultivable expanse of land lie in the marginal drought prone environment in the SSA
- ❖ Disadvantaged by a characteristically long breeding scheme due to its biology
- ❖ Production is mostly affected by biotic constraints and drought stress
- ❖ Require efficient breeding strategies - MAB

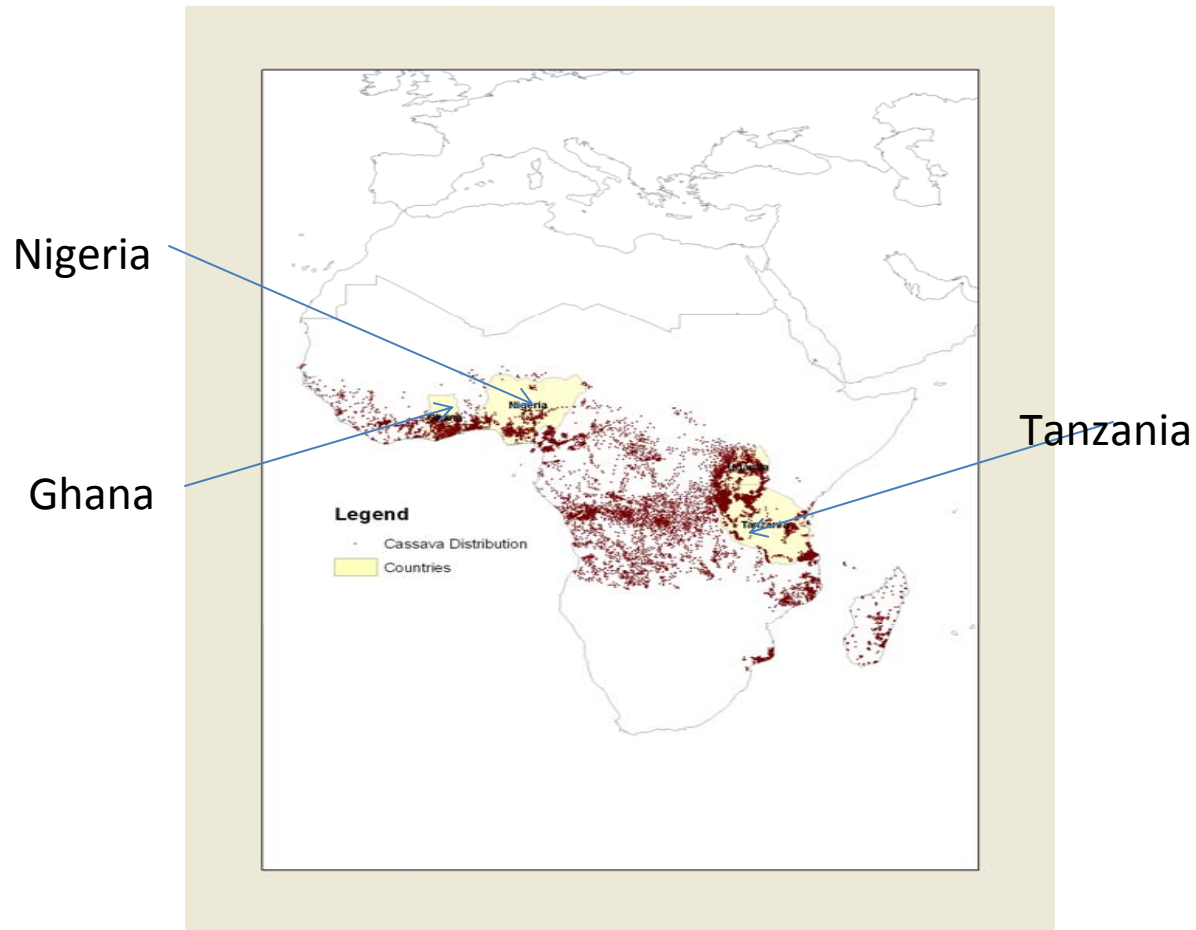
# Target countries

Three of the leading cassava producing countries in Africa selected.

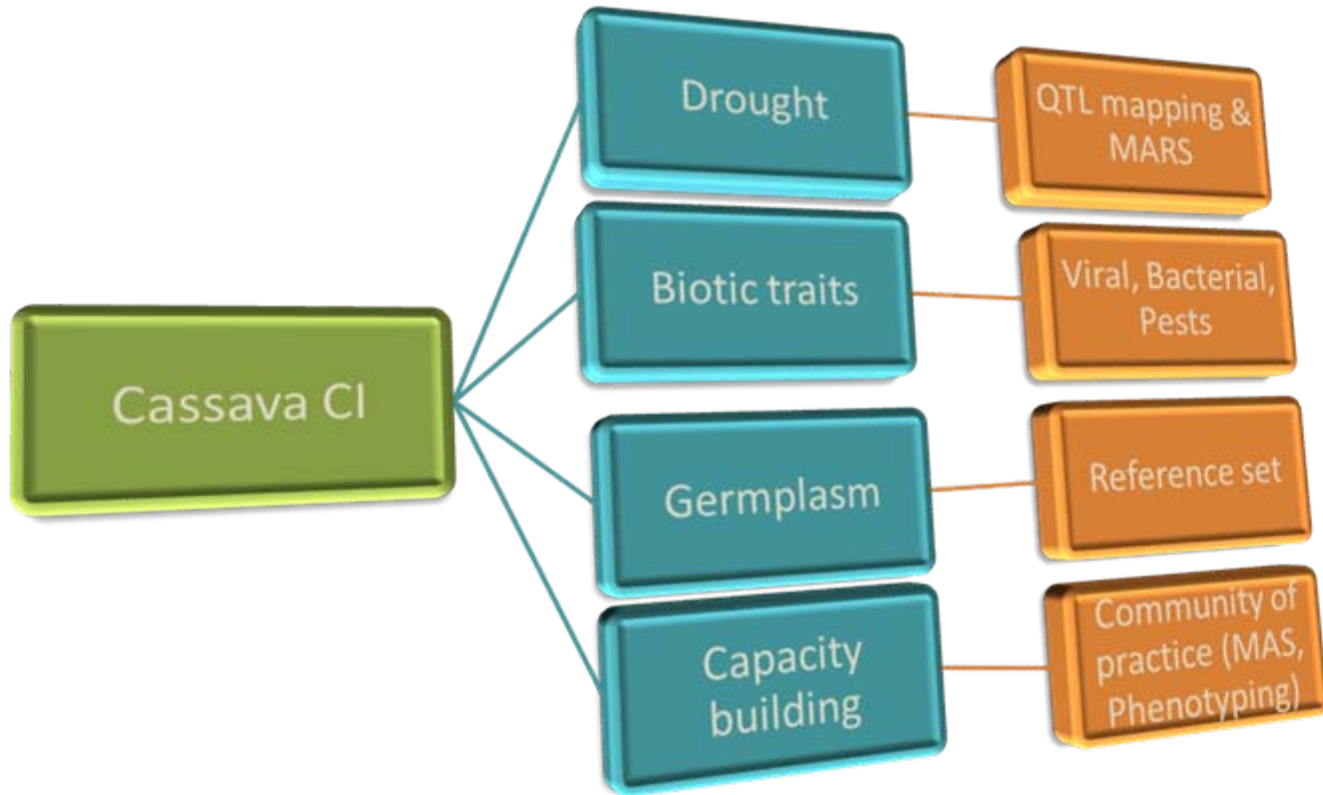
Nigeria: 45 MT

Ghana:

Uganda:

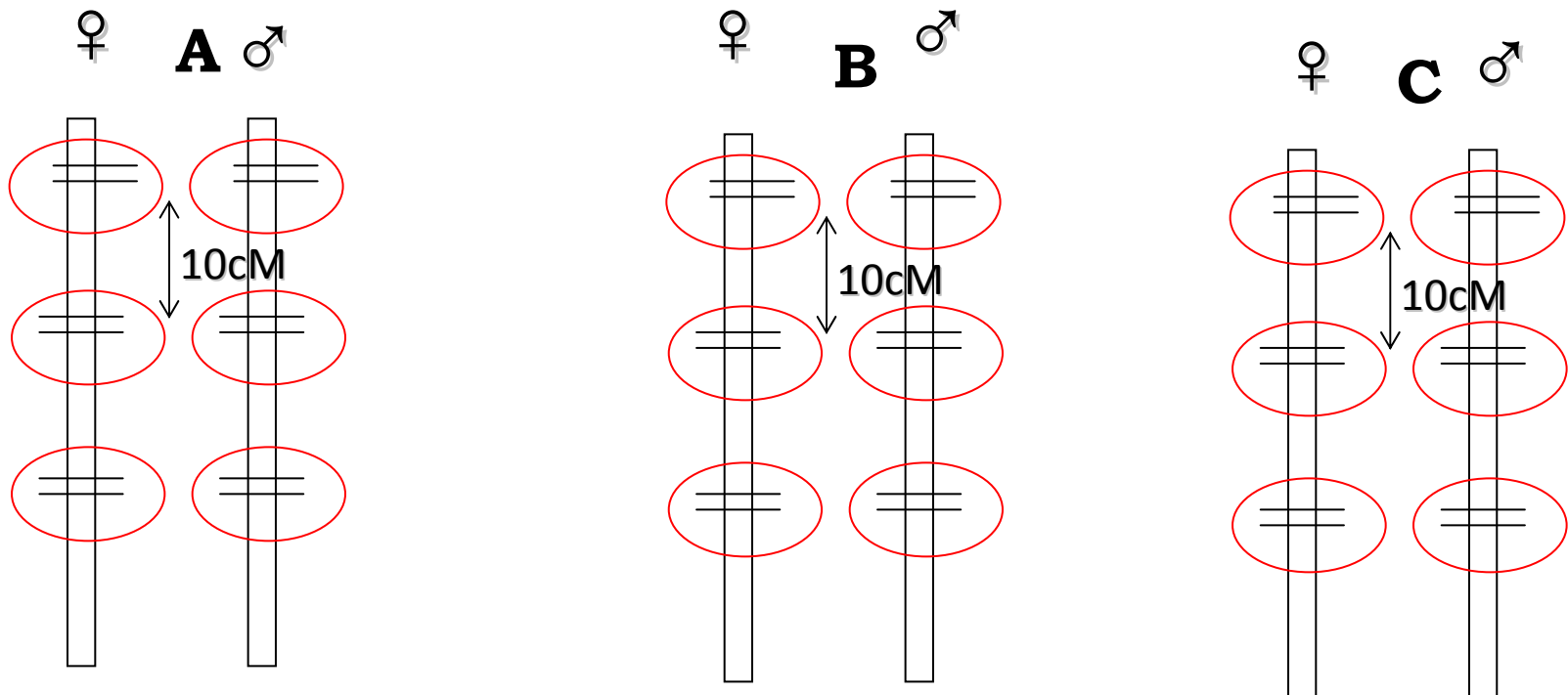


# Projects and activities



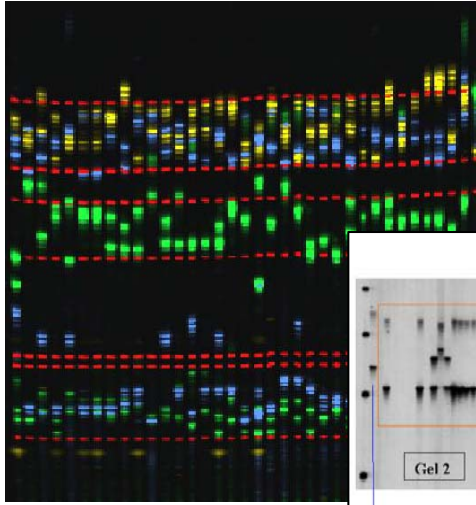
# Sources of Markers for Genetic mapping

- ❖ Bins of 4 markers every 10 cM from male- and female-parent derived genetic maps
- ❖ A total of 530 SSR markers as sources of markers

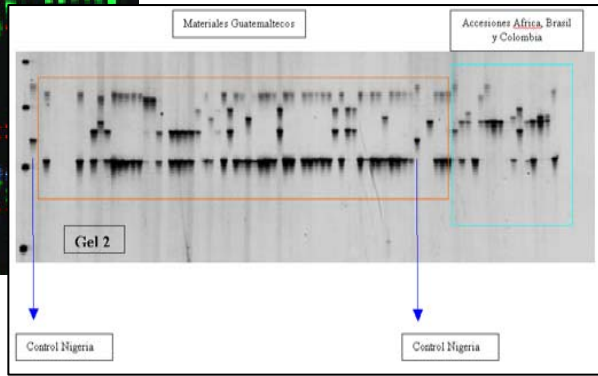


# Molecular marker system

SSR

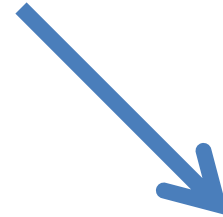


Flourescent gel



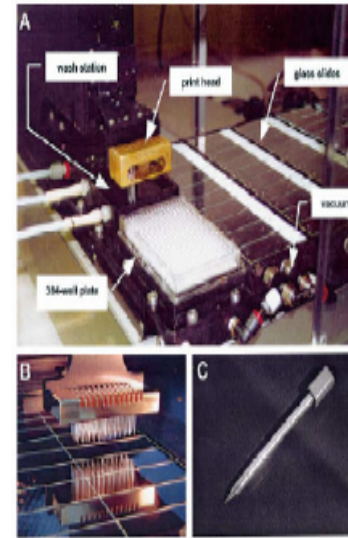
Silver stained gel

Genotyping support  
Service -GCP



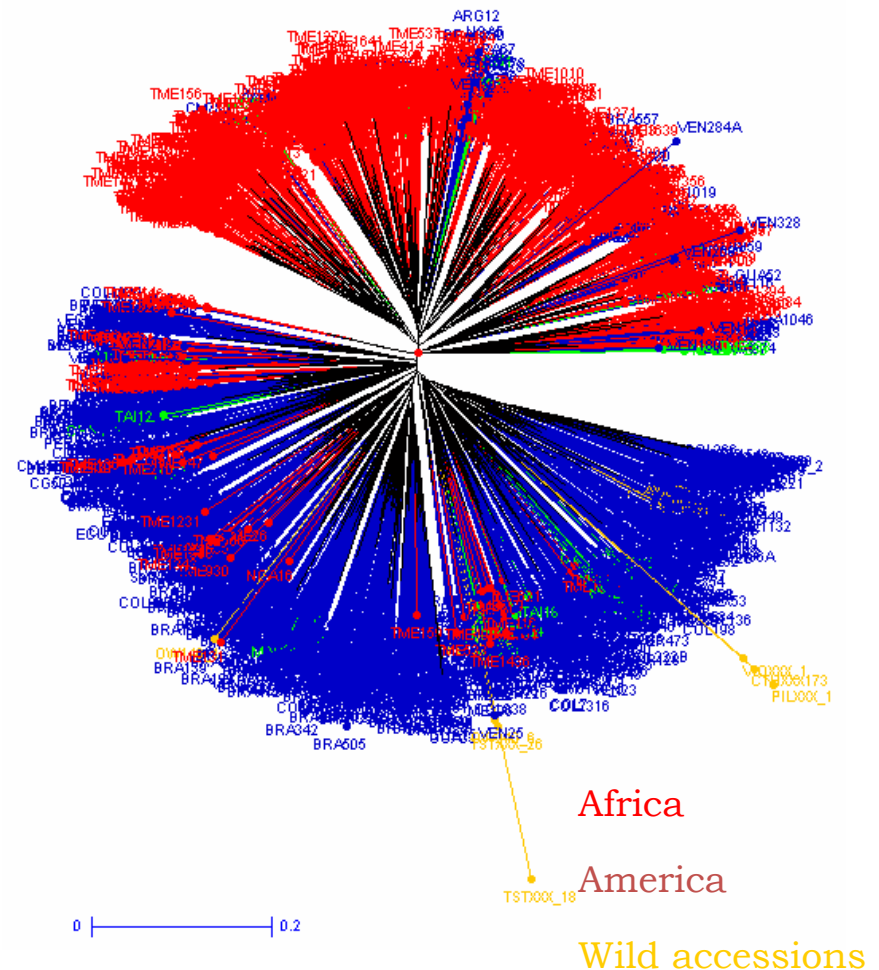
SNP

BMGF is funding SNP development



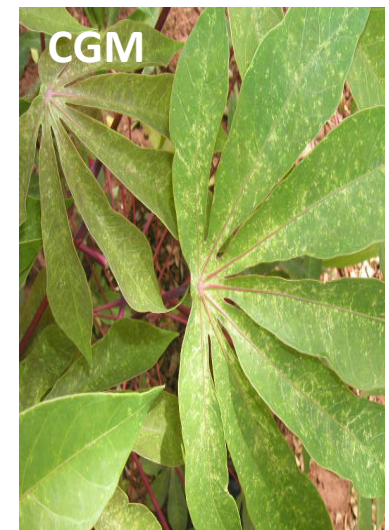
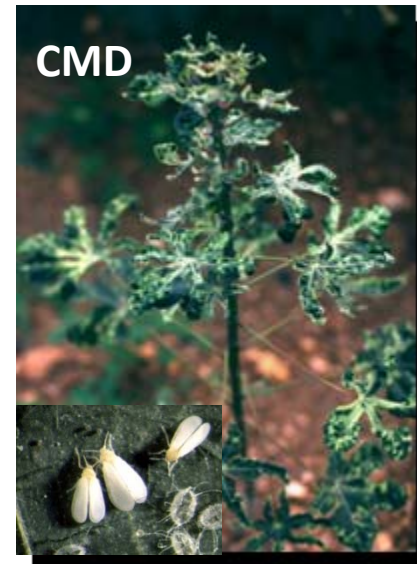
# 1. Improvement and evaluation of the existing cassava reference set for Africa

- ❖ Improve the existing reference set for Africa
- ❖ Germplasm conservation and exchange
- ❖ Fingerprint the reference set and useful breeding lines

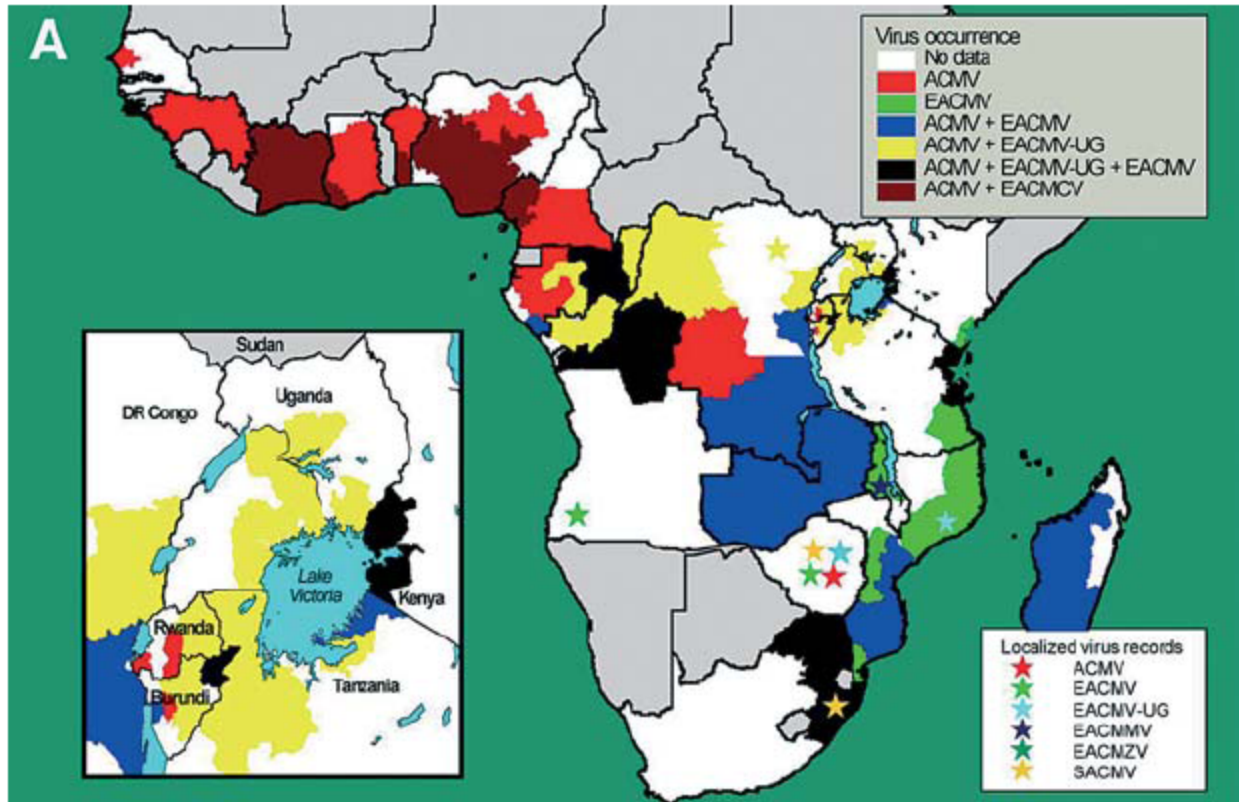


## 2. Improving and deploying markers for biotic traits

- ❖ Validation and MAS use of CBSD markers developed as part of the BMGF CBSD project
- ❖ Development and genetic mapping of new sources of CMD populations
- ❖ Screening for new source of CBB and CGM resistance



# CMD distribution in Sub-Saharan Africa



# Synergism between geminiviruses

Control



ACMV



EACMCV



Dual



Symptoms of cassava mosaic disease on cassava

### 3. Phenotyping cassava for drought tolerance to identify QTLs – Latin America

- Phenotyping cassava for some physiological traits contributing to drought tolerance
- Identification of QTLs for drought tolerance traits
- SSR, DArT and SNPs for analysis

#### Location

CIAT - Colombia

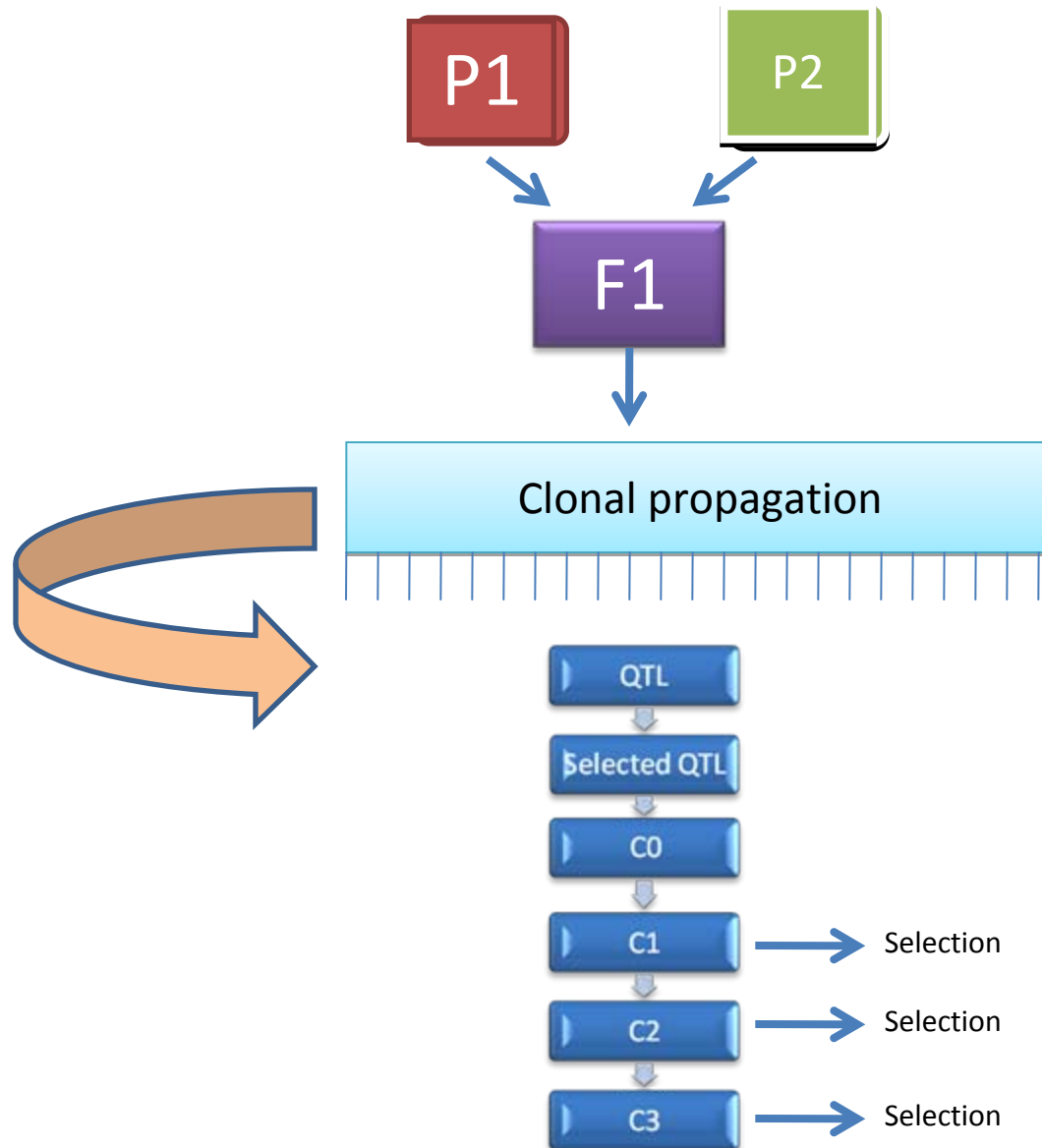
Embrapa - Brazil

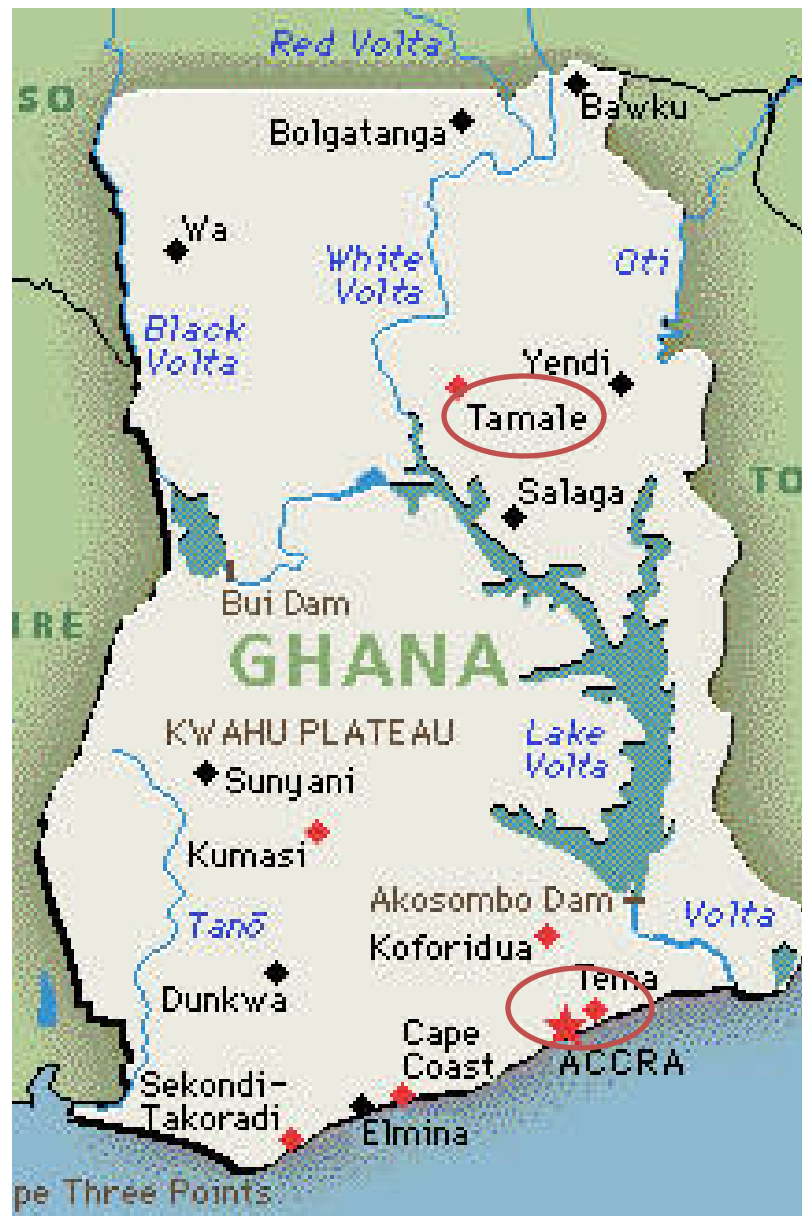


# 4. Implement MARS projects for drought tolerance (Africa)

- ❖ **Population development for MARS**
- ❖ **Genotyping**
- ❖ **Phenotypic evaluation of drought tolerance**
- ❖ **QTL mapping of drought tolerance and related traits and marker development**
- ❖ **Variety development and improvement of performance of progenitors**

# MARS scheme

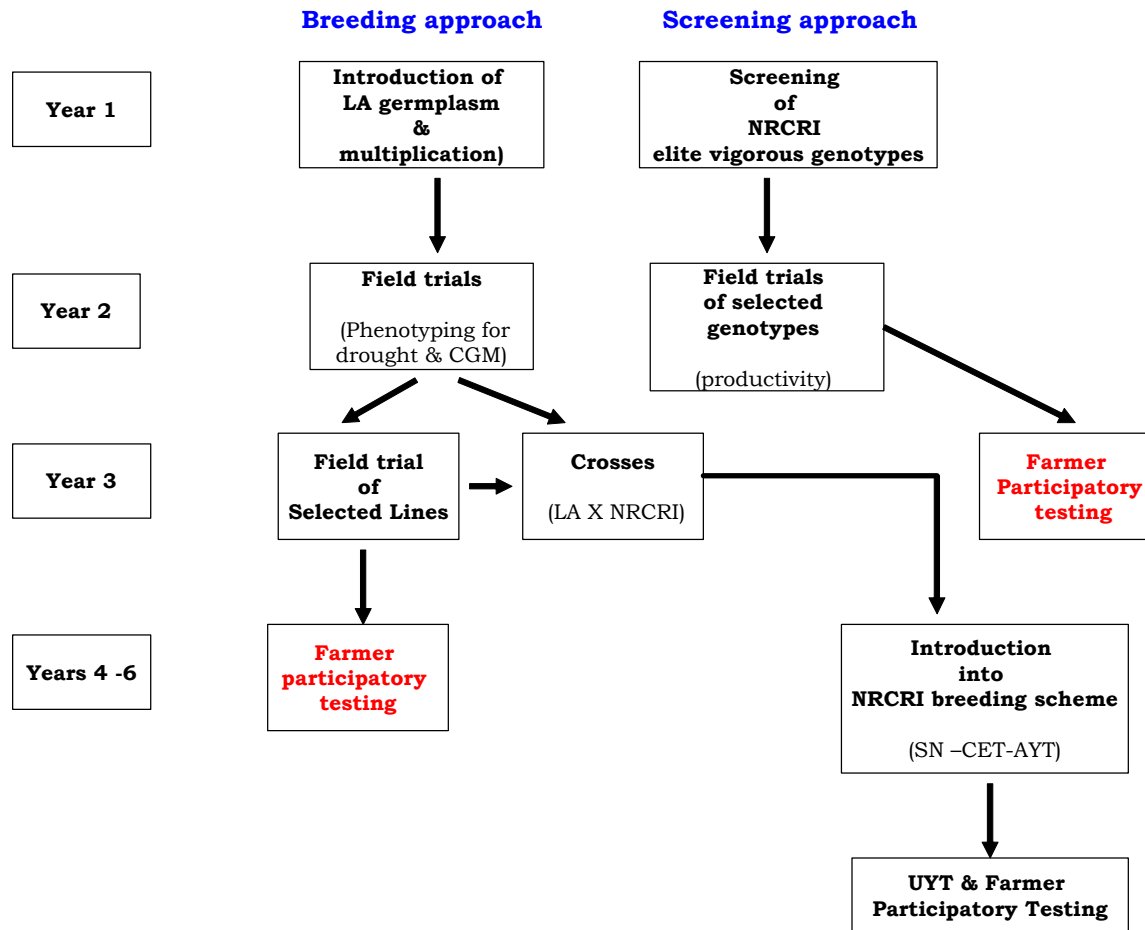






# AGRA Project for drought tolerance in cassava

Target country: Nigeria



# 5. Community of practice

- ❖ Breeder – breeder visit
- ❖ Web based database
- ❖ Elite gene pool development
- ❖ Routine use of markers in breeding
- ❖ Phenotyping for drought tolerance
- ❖ Data management and analysis
- ❖ Strengthening the capacity of National program breeders



# Expected outputs

- ❖ A reference set defined for general and trait-based diversity
- ❖ The reference set conserved *in vitro*, virus indexed and available for distribution
- ❖ 672 cassava genotypes encompassing the reference set and breeding lines fingerprinted for SNPs
- ❖ Identification of QTLs and markers linked to new sources of CMD and other biotic constraints
- ❖ Validation of QTLs for CBSD and CMD
- ❖ Partial inbred lines developed
- ❖ Development of elite gene pools combining key traits of cassava (yield, DM, resistance to pest and diseases)
- ❖ New sources for resistance to CGM and CBB identified
- ❖ Markers for desirable allelic combinations identified in germplasm used in breeding programs in Africa

# Outputs

- ❖ Marker-assisted allele combination of genes for drought tolerance and productivity
- ❖ New improved hybrid varieties for drought tolerance developed
- ❖ QTLs for drought tolerance traits identified
- ❖ One mapping population, segregating for drought tolerance, maintained under in vitro cultivation
- ❖ Cassava genotypes with source for drought tolerance identified
- ❖ Increased MAB through efficient use of marker systems and appropriate genotyping platforms for MAB
- ❖ NARs trained in phenotyping for drought tolerance
- ❖ New breeders trained in molecular breeding in participating countries

# Possible Constraints/Challenges

❖ Biology of cassava

❖ Diseases

❖ Heterozygosity

❖ Delivery link chain  
(down stream)

# Partners

- ❖ NARS
- ❖ IITA and CIAT
- ❖ Bill and Melinda Gates Foundation
- ❖ University of Arizona
- ❖ University of Maryland
- ❖ AGRA
- ❖ University of Pretoria
- ❖ African networks

# Impact

- ❖ Characterized reference set is defined and available for use in the CG and NARs
- ❖ Genetic basis of drought tolerance elucidated
- ❖ Efficient MAS breeding system for complex traits established for cassava
- ❖ New sources of resistance identified and durable resistance to biotic traits incorporated
- ❖ New molecular tools available for rapid genetic gain in breeding scheme and appropriate capacity for uptake and sustainable use of GCP products after 2014
- ❖ Improved genetic stocks for top performance hybrids available
- ❖ Useful end products in elite adapted genotypes with tolerance to drought and resistance to biotic resistance are developed for farmers

# Acknowledgement

- ❖ **Alfredo Alves**
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- ❖ **Melaku Gedil**

A photograph of a dense field of cassava plants, showing their characteristic three-lobed green leaves and thin stems. The plants are growing in rows, and the ground between them is visible. The text "Thank You" is superimposed in the center in a large, white, bold, sans-serif font.

**Thank You**