



A partnership to improve cassava comes to the aid of the rural poor in Nigeria



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Background

Nigeria, the world's largest producer of cassava consumes 90% of its production. **Cassava's great potential for food security and for alleviating poverty suggests that the country could benefit particularly from improved cassava varieties, using modern biotechnology tools.**

To promote the use of molecular tools in its cassava breeding programme, the National Root Crops Research Institute (NRCRI) in Nigeria launched a partnership with five Nigerian universities, the International Center for Tropical Agriculture (CIAT) and the Generation Challenge Programme (GCP) under Nigeria's Root and Tuber Expansion Programme.

African cassava varieties could be improved through breeding materials from wild and cultivated species in Latin America, cassava's center of diversity. However, the crop's long reproductive cycle slows introgression and pyramiding of useful genes for key desirable traits. **Marker-assisted selection (MAS) could accelerate and make these processes more efficient** (Figure 1).

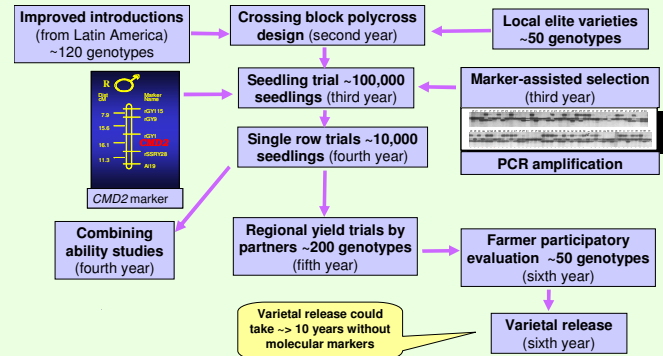


Figure 1 Improvement of Nigerian local germplasm with improved introductions

Partnership objectives

- To provide the NRCRI and Nigerian universities with high throughput genotyping services that will **identify molecular tags for useful genes** such as resistance to major pests and diseases in cassava elite clones and germplasm and so permit an accelerated development of enhanced varieties
- To **improve the capacity and productivity of Nigerian scientists**
- To **enhance the livelihoods of cassava growing communities through improved varieties** that produce more reliable harvests (Figure 2)



Figure 2 Successful use of improved cassava varieties: (A) farmers obtain stable high yields; (B) an agroenterprise grows with improved cassava production, thus leading to improved livelihoods; and (C) on an industrial scale, a successful starch factory will help increase the country's domestic and foreign earnings

The partnership's achievements so far

- **Selection of the first set of three genotypes** for acid-soil tolerance, high yields, high tuber dry matter, and resistance to cassava mosaic disease (CMD), **using markers** in pre-release multi-environment trials in Nigeria in 2006
- **Large mapping populations segregating for CMD** and developed from novel putative sources of resistance as well as other important traits (Figure 3A)
- **Molecular marker-assisted laboratory established for the first time** in a cassava research organization in Nigeria
- **Three cassava breeders from Nigeria trained** in phenotyping and molecular breeding (Figure 3B)
- **Completed assessment of the genetic diversity** of elite Nigerian germplasm, using SSR markers
- **Farmer participatory selection** of marker-selected germplasm to begin soon
- **Reduced time for selection** implies more efficient cassava breeding

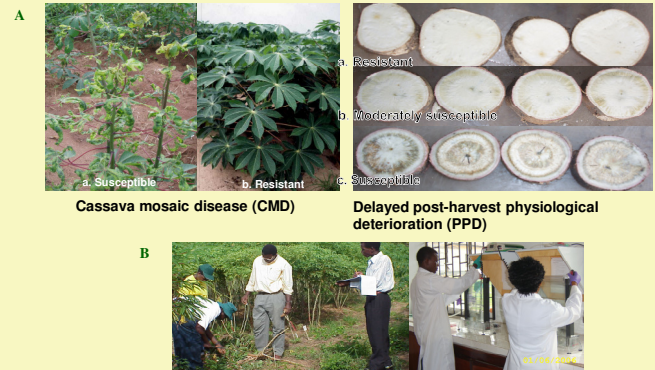


Figure 3 Molecular breeding in Nigeria: (A) for resistance to biotic and abiotic stresses; and (B) training 3 breeders in phenotyping and molecular breeding.

The respective roles in the partnership

The roles of the **Nigerian partners**: NRCRI and the five universities mentioned above - are to:

- Understand the needs of the cassava stakeholders, define the goals of the research program, perform the phenotypic evaluation of germplasm, disseminate research results, and contribute to the scientific education of future Nigerian professionals
- Propose to the GCP the sets of germplasm for genotyping
- Extract DNA and confirm that it complies with the genotyping laboratory's requirements for analysis
- Participate actively in data analysis and interpretation, acquire capacity, and propose ways to improve the breeding strategies using knowledge acquired from genotyping

Through the Genotyping Support Service (GSS), the role of the GCP:

- To provide funds and create the linkages needed for genotyping services and data analyses
- Facilitates access to specialists in biometrics and statistics

The role of the genotyping laboratories at CIAT, and elsewhere:

- To advise the Nigerian partners on DNA extraction and quality testing
- To conduct the genotyping of sets of selected germplasm
- To assist Nigerian partners on data analysis and interpretation

Improving and expanding the partnership

Limitations will be reduced in several areas identified as needing support for faster progress:

- Basic infrastructure (energy supply, water quality for analytical applications, and availability of reagents, etc.) that keep laboratory facilities underused
- Further capacity building in phenotyping in areas such as experimental design, plant labeling, data management (acquisition, safer storage) and analyses, measures to prevent losses, etc.

- Acquisition of environment-related data that confound genetic effects such as variation in soil characteristics and weather factors
- **Future plans include molecular tagging of high value traits in cassava such as waxy starches, sugary types, high protein, etc.**
- **Forming networks and partnerships among breeding programmes and providing support on regional basis**