



Products and results from Phase I (2004–2008)

Research and use of genetic resources

Exploring and harnessing diversity

- **Investigating diversity:** Analysed genetic diversity for 21 food crops (see list in poster *Defining and refining priorities: our strategy through time*)
- **Reference sets:** Assembled reference sets for 21 food crops
- **Genetic stocks:** Developing genetic stocks, such as collections of mutants, introgression lines, mapping populations and near isogenic lines
- **Crosses:** developing new crosses, using accessions of the reference sets
- **Phenotyping:** Phenotypic characterisation for different targets and locations

Research in, and use of, genomic resources

Investigating genes, more genes and drought tolerance

- **Genomic tools:** With partners, establishing platforms for genotyping, informatics and genomics, so breeders can access modern technologies
Our results thus far include:
 - ▲ Marker resources for cassava, chickpeas, cowpeas, *Musa*, pigeonpeas and potatoes
 - ▲ Large-scale marker platform for beans, rice and sorghum, in order to apply modern marker-assisted breeding approaches
- **Wider genetic base:** Incorporating genes from the wild relatives of groundnuts and wheat to broaden crop genetic base
- **Selecting for major genes:** Identifying major genes for virus resistance in cassava, aluminium tolerance in sorghum, and phosphorous uptake in rice
- **Deciphering drought-tolerance and extending knowledge frontiers:**
 - ▲ Better understanding of drought tolerance: knowledge on genetic basis and physiological pathway regulating drought tolerance
 - ▲ Identifying a large number of candidate genes and genomic regions contributing to drought tolerance
 - ▲ Testing the efficiency of comparative genomics

Validation, delivery tools and capacity development

Validating, tools and enhanced capacity for product delivery and information sharing

- **Validation, new approaches and advances on markers**
 - ▲ Validated markers for disease resistance (downy mildew in maize; yellow mottle virus and bacterial leaf blight in rice; *Striga* in cowpeas; golden yellow mosaic virus and root rot in beans; cassava mosaic diseases, and late blight; tuber moth, *Diabrotica*, leaf-roll virus and bacterial wilt in potatoes)
 - ▲ Validated markers for tolerance to soil nutritional constraints, aluminium toxicity and salinity in Niger, Bangladesh and Indonesia, respectively.
 - ▲ New approaches and methodologies to improve efficiency of marker-assisted breeding in drought-prone environments
 - Improved prebreeding germplasm for dissemination to breeders
 - Refining phenotyping protocols, including drought phenotyping
 - Better characterisation of the environment through GIS
 - Several QTLs for drought identified and under validation for rice, wheat and several legumes
- **Crop bioinformatics**
 - ▲ Fully functional research information platform and database
 - ▲ Informatics tools for scientists to store, analyse and compare data, including:
 - A tool for analysis and test sequences on genes (GreenPhyl Orthologous Search Tool – GOST)
 - Extending use of GOST beyond GCP, and enhancing user-friendliness
 - Enhancing and disseminating ICRISAT's Laboratory Information Management System (LIMS)
 - A marker-assisted selection software for developing country partners (Integrated Marker-Assisted Selection System – iMAS)
- **Tools to facilitate product delivery**
 - ▲ Project Delivery Plan Kit (DPKit): a planning tool for identifying – in advance – project products, users of these products, constraints and capacity needs
 - ▲ Project Development Guide (PDG): a web-based resource for proposal development, project design and monitoring, relevant to both researchers as well as research managers and reviewers
 - ▲ Workflow Management System (WMS): a searchable information management system to integrate and consolidate project information
- **Capacity enhancement**
 - ▲ Customised capacity enhancement in modern breeding, on GCP-related themes
 - Beneficiaries to date: Nine applied research teams, 24 fellows and 78 travel grantees
 - Facilitating primary users of GCP products in target developing countries to integrate these products in their breeding activities.
 - Platform established for rice researchers in Asia
 - Community of practice established for use of cassava markers in Africa
 - ▲ Learning materials on genetic policies, genomics and bioinformatics, available online and on CD-ROM. Four more sets under development (genetic diversity, marker-assisted selection, phenotyping and association genetics)

Building a vibrant R&D community (see poster on *The GCP R&D community*)

What's in the pipeline for Phase II in 2009–2013?

- **Applying lessons learnt in Phase I:** identifying 'winners' and effective approaches and building on these successes, and devising strategies to overcome challenges encountered or anticipated
- **Sharpening our focus:** greater focus in our research agenda for tangible impact by 2013 on selected crops, traits and target regions (see poster on *Defining and refining priorities*)
- **Demonstrating the viability of our approach**
 - ▲ **Proof of concept:** While we expect a spillover beyond our target regions, impact on breeding will be our proof of concept, given that we have limited resources
 - ▲ **Impact:** By presenting case studies that illustrate the movement of research products along the research–delivery pathway, GCP will continue to demonstrate that a research approach tapping into crop diversity and using modern biotechnology-based breeding can have impact on crop breeding in drought-prone environments
- ▲ **What next?** By so doing, we hope that R&D initiatives and national governments will be willing to further build on GCP achievements, and extend the achievements based on the same – or similar – approaches.
- **Ensuring sustainability into the future**
 - ▲ **Product availability and sustainability:** We realise the importance of product availability and sustainability, hence the investment in platform development in Phase II (platforms concept explained in poster titled *Defining and refining priorities*). By 2013, GCP will be evaluated based on the frequency and intensity of the use of our products.
 - ▲ **Evolution strategy:** Designing a viable evolution strategy for the Programme by 2013

Impact in the future: Because we work upstream on the research–delivery pathway and our direct engagement ends at the prebreeding stage, realistically, GCP's true impact will only fully realised in the future, after the Programme's lifetime. Therefore, while our ultimate target remains resource-poor farmers, we do not expect our products to reach farmers within our lifetime.