Generation Challenge Programme
CULTIVATING PLANT DIVERSITY FOR THE RESOURCE-POOR

The CGIAR Generation Challenge Programme in Asia

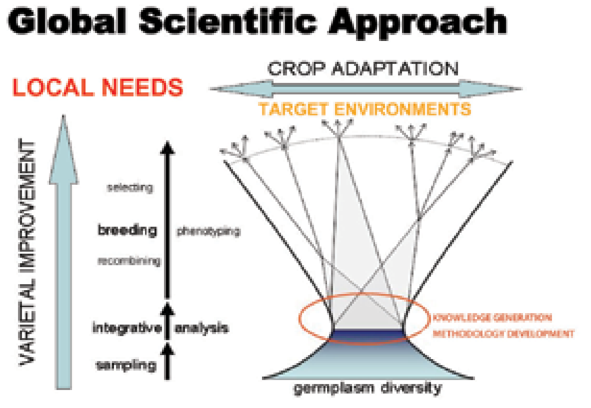
Research strategy

One of the strongest motivations for creating the Generation Challenge Programme (GCP) in 2003 was to fill the gap in translational biology between fundamental and applied research. GCP links laboratories in developed economies with user communities in developing countries to accelerate the use of elite genetic stocks and new marker technologies for crop breeding (see companion poster for more details on GCP).

GCP is a novel approach to research-for-development, bringing genomic science to bear on the agricultural constraints of farmers in the world's poorest countries. More than ever, varietal improvement relies on a profound understanding of the genetic basis of functional diversity that will serve to broaden crop adaptation and improve productivity by increasingly accumulating new or existing favourable alleles.

GCP's approach to science is based on the concept that genetic resources (which provide the raw materials) should interact with both advanced biological exploration (which provides an understanding of the genetic basis of traits) and breeding programmes (which realise value by applying conventional and advanced methods to produce new and improved varieties).

Because of its exceptional network of partners, consisting of nine CGIAR centre, more than 30 advanced research institutes (ARIs) in the global North as well as the South, and about 35 national programmes, GCP is uniquely positioned to deliver new tools to breeders, thus enhancing efficiency in crop improvement.



Flows in varietal improvement:
broadening crop adaptation by tapping germplasm diversity

Partners and plants

Our work in Asia mainly focuses on rice, wheat, maize, pearl millet, pigeon peas, chickpeas, groundnuts and coconut.

Partners in 2007 include institutes in the following countries (in alphabetical order):

- Bangladesh
- Cambodia
- China
- India
- Indonesia
- Iran
- Japan
- Laos
- Myanmar
- Philippines
- Sri Lanka
- Syria
- Thailand
- Vietnam

In Asia as elsewhere, national agricultural research programmes are evolving and are at different stages in terms of research capacity, calling for different approaches to capacity-building and collaboration. While some national programmes have suffered serious setbacks, others have surged ahead over the last two decades to become mutual partners in international agricultural research, thus requiring less direct training and support.

Examples of these advanced research programmes in Asia include China, India and Thailand. Due in part to significant government funding, these countries now count among the global leaders in plant genomics.

Priority regions and crops

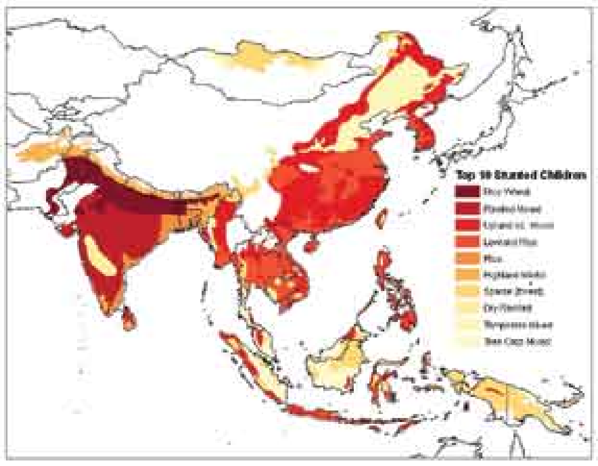
We define the locations and crops for our work in Asia by 'zooming in' on hunger and environmental 'hotspots' from a global context. Starting with 64 farming systems worldwide (10 of which were in Asia), we filtered down to 15 global priority systems, eight of them in Asia, based on the coincidence of the following parameters:

1. poverty, using infant mortality and child malnourishment and stunting as indicators;
2. drought; and,
3. key staple crops for the poor in each farming system.

High impact systems in Asia: stunting, crops, failed seasons

Farming system	Stunted children (millions)	fsg*	fsr**	Crops
S Asia rice wheat	28.3	1	1	wheat, rice, pulses (chickpea), maize
S Asia rainfed mix	24.5	3	2	rice, millet, sorghum, pulses (chkp), wheat, bean, groundnut, maize
E Asia upland int mix	15.4	8	3	rice, maize, wheat
E Asia lowland rice	13.4	6	2	rice, wheat, maize, sweet potato
S Asia rice	11.7	27	6	rice, pulses (chickpea)
S Asia highland mix	5.2	21	5	rice, wheat, maize, pulses (chickpea), millet
S Asia dry rainfed	3.6	11	3	millet, sorghum, rice, pulses (chickpea), groundnut, wheat
E Asia temp mixed	2.6	5	1	Maize, wheat, rice, groundnut

*fsg: global (farming system) ranking according to potential drought impact index
**fsr: regional (farming system) ranking according to potential drought impact index



Projects and activities

Research

Below is a slice of some of our projects across Asia:

Adapting rice cultivars to saline and P-deficient soils: We have identified major rice QTLs (saltol for salinity and Pup1 for P deficiency), and developed and validated markers for both QTLs. These markers will be used to introduce salinity tolerance and P deficiency in adapted rice cultivars in Bangladesh and Indonesia, respectively. We will also strengthen the capacity of these national programmes in marker-assisted breeding.
Partners: *International Rice Research Institute (IRRI), in collaboration with national programmes in Bangladesh and Indonesia*

Developing markers for maize resistance to downy mildew (Peronosclerospora sorghi): The objective is to develop markers for resistance to downy mildew (Peronosclerospora sorghi), one of the most destructive maize diseases in Thailand. We already have DNA sequence data for 3 genes from coding regions and flanking sequence based on each chromosomal location near major QTLs. The five genomic regions are for chromosomes 2, 3, 5, 6 and 9.
Partners: *Kasetsart University, Bangkok, in collaboration with BIOTEC Thailand and the Nakhon Sawan Field Crop Research Center, Thailand*

Integrating marker-assisted selection into conventional wheat breeding for drought-tolerance: The Chinese Academy of Agricultural Sciences (CAAS) has developed a doubled haploid population based on a cross between two Chinese wheat varieties, Hanxuan 10 and Lumai 14, and also identified and validated large-scale drought tolerance QTLs. This project is now using these QTLs to develop marker-assisted selection programmes. Drought tolerance QTLs are being introgressed in elite Chinese wheat backgrounds from across China, representing a total of 10 million hectares. A drought phenotyping network and a genotyping platform are being established and scientists from the different provinces trained in wheat molecular breeding, marker-assisted selection techniques and drought phenotyping.
Partner: *Chinese Academy of Agricultural Sciences (CAAS)*

Capacity-building

Capacity-building is central in GCP. Some of our more recent capacity-building efforts in Asia include:

- ***Networking:*** establishing and supporting a community of practice for breeders in the Mekong Region
- ***Fellowships:*** Out of 15 GCP fellowships in 2005–2006, nearly half (7) were from Asia
- ***Travel grants to international conferences:*** 18 out of 47 travel grantees in the same period were Asian
- ***Training courses:*** In 2006, Asia accounted for approximately half the participants in our courses in phenotyping and water deficit; database and information management; and plant genetic resources, as illustrated.

Training Courses 2006

Phenotyping and Water Deficit (23 participants, 11 from Asia)
Plant Databases, Internet Resources and Bioinformatics (21 participants, 10 from Asia)
Plant Genetic Resources and Seeds: Policies, Conservation and Use (24 participants, 12 from Asia)

GCP and Asia

Asia is a key target area for GCP, and this is clearly demonstrated by the exemplary set of partners we work with in Asia all along the GCP chain of activities and product delivery, and also our customised support for capacity-building in the continent. We are already testing GCP products with some of our national partners, with the ultimate shared goal of improving crop productivity in Asia.