



Generation Challenge Programme

For millennia, generations of farmers have known about – and used – plant genetic diversity. Farmers identify plants with particular traits, or plants that thrive in unfavourable conditions. Seeds and cuttings from these selected plants are carefully preserved for the next sowing season. This ancient and time-tested breeding strategy is now the root of novel plant science in our time.



Our mission: Using genetic diversity and advanced plant science to improve crops for greater food security in the developing world.

Who we are

The Generation Challenge Programme (GCP) is one of five Challenge Programmes of the Consultative Group on International Agricultural Research (CGIAR). GCP is a broad network of partners from developing- and developed-country research programmes, collectively working at both the national and international level to increase crop productivity, particularly in drought-prone farmlands. GCP partners draw on plant diversity, and on existing and new technologies to improve crops with desired traits. Through this wide range of partners, GCP links basic science with applied research and helps to weave an effective and interactive community of crop researchers at both the global and regional levels.

Why is plant genetic diversity important?

First, plant genetic diversity is obvious: for the same crop, some plants are tall and some short, some survive extreme climates, or are naturally pest-resistant. Deciphering the full set of the plant's genetic information – also known as the plant genome – reveals to us the exact factor responsible for these

differences. This knowledge is then used by crop breeders to generate better-adapted offspring (progeny).

Through the years, researchers have also used this knowledge to gather select genetic material from crops and their wild cousins, thus safeguarding these natural resources for current and future generations. This material is preserved in more than 1,400 'gene banks' – the custodians of genetic diversity. Yet, while these banks currently hold an estimated six million select samples, less than one percent has been used by breeders since there are no data or information on their *actual* application in breeding.

In Phase II (2009–2013), one of GCP's goals is to draw this diversity out of gene bank vaults, and apply it to improving plants today, in addition to continued collection and conservation for the future.

What is GCP's core business?

We selectively characterise the diversity of the most important crop germplasm for agriculture, including collections stored in gene banks under the custody of the CGIAR

as well as country research programmes. Using this diversity, GCP applies genomic tools and interdisciplinary approaches to better understand gene function and gene interactions. This understanding of gene systems across crops helps to identify and tag genes which contribute desired agronomic traits. Selection of favourable alleles (ie, variants) of those genes increases the efficiency, speed and scope of plant breeding.

GCP also integrates information components and analysis tools into a coherent information gateway and provides support for data storage and analysis. To ensure impact, GCP empowers scientists in developing country programmes to use modern breeding. In Phase II (2009–2013), our strategy emphasises product management and delivery as crucial cornerstones of GCP's work in the coming years: concepts and ideas at GCP founding are increasingly evolving into useful GCP products, and we remain committed to delivering practical and relevant products to boost breeding and, ultimately, have impact on crop productivity in farmers' fields. The main avenues to achieving this will be through delivery platforms and crop- and region-specific Research Initiatives (see *inside*).



Why GCP?

GCP's network helps to advance the frontiers of knowledge and develop practical tools such as molecular markers for desirable genes, so as to promote efficient field selection in plant breeding. Through our network of partners in the CGIAR, as well as in the public and private sector, GCP implements projects and programmes that bring together plant scientists from different disciplines to improve crops for the ultimate benefit of resource-poor farmers. GCP works with cutting-edge plant biology research partners, and augments the efforts of the CGIAR and the broader agricultural research-for-development community.

“Perhaps the most important value of GCP thus far, is the opportunities it has provided for people of diverse backgrounds to think collectively about solutions to complex problems, and, in the process, to learn from one another.”

– Excerpt from the report of the External Programme and Management Review, March 2008

A complementary research–services approach

In Phase II, GCP has taken a complementary approach, building on a set of focused research components and an integrated service component. The approach is complementary because appropriate services are indispensable for research to deliver expected outputs and products, while the seven Research Initiatives (RIs) – which are the core users of the services – help in prioritising and shaping the content and format of the different modules the service platform offers. As such, services are defined by a demand-driven approach to serve user needs.

The service platform is conceived as a vehicle for disseminating technology and knowledge by enabling broad access to the latest breeding tools and services, while the RIs aim to demonstrate that modern and integrated breeding approaches can have significant impact on crop productivity in developing countries.

Research Initiatives

While GCP Phase I had a general and thematic approach across 18 crops in GCP's early years, Phase II is defined by a more sharply focused proof-of-concept approach, and is therefore crop- and region-specific. GCP's resources are now primarily devoted to Research Initiatives covering nine crops, with particular focus on 17 countries in Africa (13) and Asia (4):

Cereals

1. Improving drought tolerance in rice for Africa
Burkina Faso, Mali, Nigeria
2. Drought-tolerant maize for Asia
China, India, Indonesia, Thailand
3. Improving drought tolerance in wheat for Asia
China, India
4. Improving drought tolerance in sorghum for Africa
Mali
5. Comparative genomics to improve cereal yields in high-aluminium and low-phosphorous soils (maize, rice, sorghum)
Indonesia, Kenya, Zambia

Legumes

6. Improving drought tolerance in beans, cowpeas, chickpeas and groundnuts for Africa and Asia
 - Beans: *Ethiopia, Kenya, Malawi, Zimbabwe*
 - Chickpeas: *Ethiopia, India, Kenya*
 - Cowpeas: *Burkina Faso, Mozambique, Senegal*
 - Groundnuts: *Malawi, Senegal, Tanzania*

Root and tubers

7. Improving cassava yield in Africa's drought-prone environments
Ghana, Nigeria, Tanzania

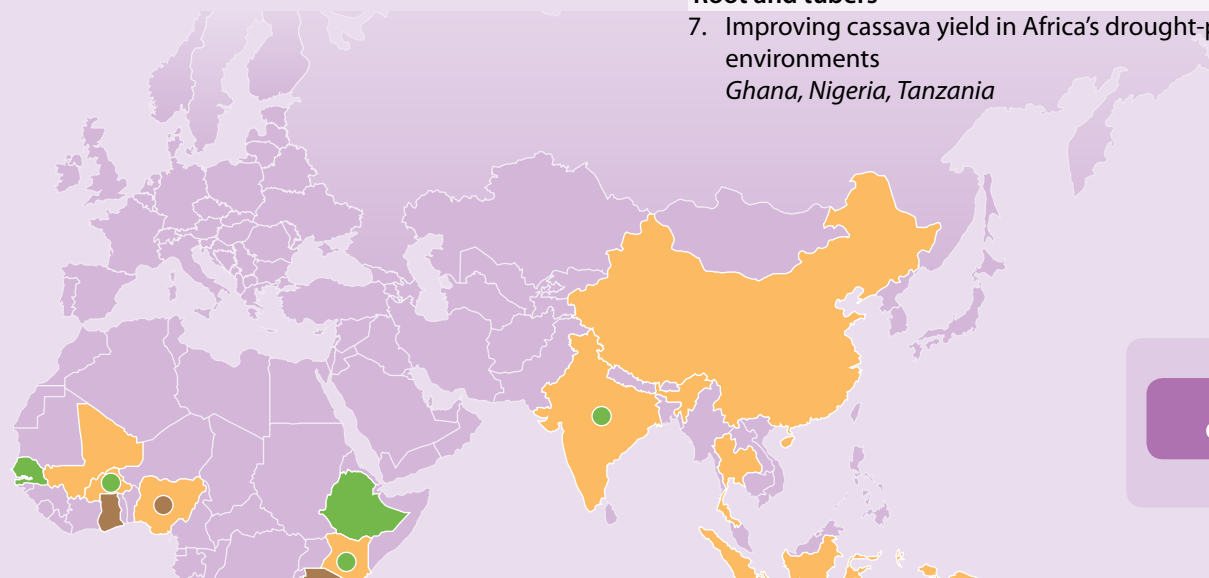
Services

A major goal for GCP in early Phase II is to create a set of plant breeding support services as sustainable public goods. This will facilitate access by developing-world breeders to modern plant science technologies at optimal cost and with logistical and technical support.

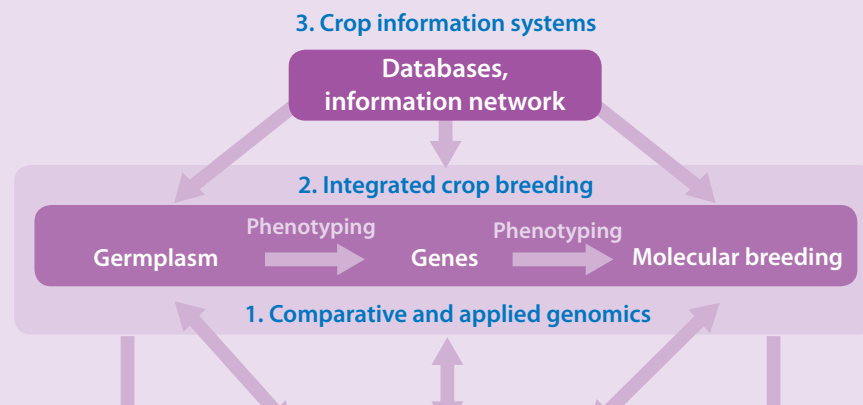
To this end, GCP's Integrated **Breeding Platform (IBP)** is geared to address specific needs identified by developing-country breeders. IBP was launched in mid-2009. It encompasses several breeding services which address germplasm, markers and traits. The services are all inter-related and complementary, but each component – or service – can also be used independently.

Data management and access are critical pillars of the platform.

GCP's Medium-Term Plan for 2011–2013 proposes expanding IBP to include a genomics component, and to considerably enhance the existing capacity-building activities. Should this be approved, IBP will be renamed the Genomics and Integrated Breeding Service (GIB Service) to reflect this expansion.



GCP's thematic activities





Where in the world is GCP? The GCP network in 2009

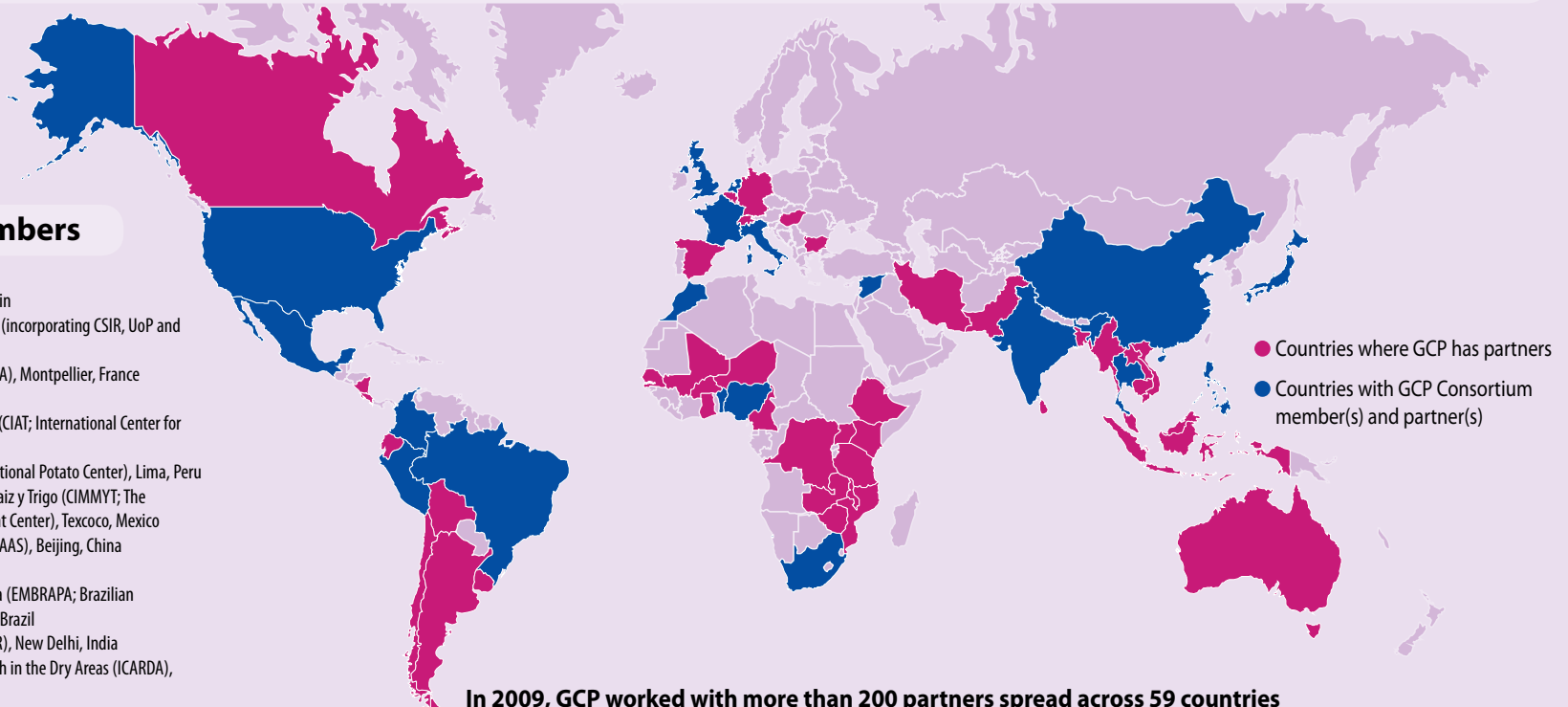
GCP Consortium members

Full members

1. Africa Rice Center (AfricaRice), Cotonou, Benin
2. African Centre for Gene Technologies (ACGT) (incorporating CSIR, UoP and UotW), Pretoria, South Africa
3. Agropolis (incorporating CIRAD, IRD and INRA), Montpellier, France
4. Bioersity International, Rome, Italy
5. Centro Internacional de Agricultura Tropical (CIAT; International Center for Tropical Agriculture), Cali, Colombia
6. Centro Internacional de la Papa (CIP; International Potato Center), Lima, Peru
7. Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT; The International Maize and Wheat Improvement Center), Texcoco, Mexico
8. Chinese Academy of Agricultural Sciences (CAAS), Beijing, China
9. Cornell University, Ithaca, New York, USA
10. Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA; Brazilian Agricultural Research Corporation), Brasília, Brazil
11. Indian Council of Agricultural Research (ICAR), New Delhi, India
12. International Center for Agricultural Research in the Dry Areas (ICARDA), Aleppo, Syria
13. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India
14. International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria
15. International Rice Research Institute (IRRI), Los Baños, The Philippines
16. John Innes Centre (JIC), Norwich, UK
17. National Institute of Agrobiological Sciences (NIAS), Tsukuba, Japan
18. Wageningen University and Research Centre (WUR), Wageningen, The Netherlands

Provisional members

19. Centro de Investigación y de Estudios Avanzados (CINVESTAV), Irapuato, Mexico
20. Institut national de la recherche agronomique (INRA), Rabat, Morocco
21. Istituto Agronomico per l'Oltremare (IAO), Florence, Italy
22. National Center for Genetic Engineering and Biotechnology (BIOTEC), Bangkok, Thailand



In 2009, GCP worked with more than 200 partners spread across 59 countries

Developing-country partners

Central and West Asia and North Africa

1. Iran
2. Morocco
3. Syria

East Europe

4. Bulgaria
5. Hungary

Latin America and the Caribbean

6. Argentina
7. Bolivia
8. Chile
9. Colombia
10. Costa Rica
11. Ecuador
12. Nicaragua
13. Peru
14. Uruguay

South and Southeast Asia

15. Bangladesh
16. Cambodia
17. Indonesia
18. Laos
19. Myanmar
20. Pakistan
21. Sri Lanka
22. Vietnam

Sub-Saharan Africa

23. Benin
24. Burkina Faso
25. Cameroon
26. Democratic Republic of Congo
27. Ethiopia
28. Ghana
29. Kenya
30. Malawi
31. Mali
32. Mozambique
33. Niger
34. Nigeria
35. Senegal
36. Tanzania
37. Uganda
38. Zambia
39. Zimbabwe

Newly industrialised countries

Latin America and the Caribbean

40. Brazil
41. Mexico

South and Southeast Asia

42. China
43. India
44. Malaysia
45. Thailand
46. The Philippines

Sub-Saharan Africa

47. South Africa

Industrialised country partners

Asia

48. Japan

Europe

49. Belgium
50. France
51. Germany
52. Italy
53. Spain
54. Switzerland
55. The Netherlands
56. United Kingdom

North America

57. Canada
58. USA

Oceania

59. Australia



Created by the CGIAR in 2003 as a timebound 10-year Programme, GCP's goal is to add value to crop breeding, targeting farmers in drought-prone and harsh environments. Through capacity-building and by assisting developing-world researchers to tap into a broader and richer pool of plant genetic diversity, GCP strives to ensure that crops improved by cutting-edge science will reach farmers in the developing world.

Funding: GCP's annual budget of about USD 15 million is supported by the generosity of various funders, most coming through the CGIAR. In Phase I (2004–2008), our major funders were the European Commission, the UK's Department for International Development and the World Bank. The Bill & Melinda Gates Foundation has become a major funder In Phase II (2009–2013), alongside these three continuing funders. Collectively, the four contribute about 90 percent of GCP's total income.



Generation Challenge Programme

CGIAR Generation Challenge Programme (GCP)
Hosted by CIMMYT

(Centro Internacional de Mejoramiento de Maíz y Trigo;
the International Maize and Wheat Improvement Center)

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