# Today's tools for tomorrow's crops

**Introduction**

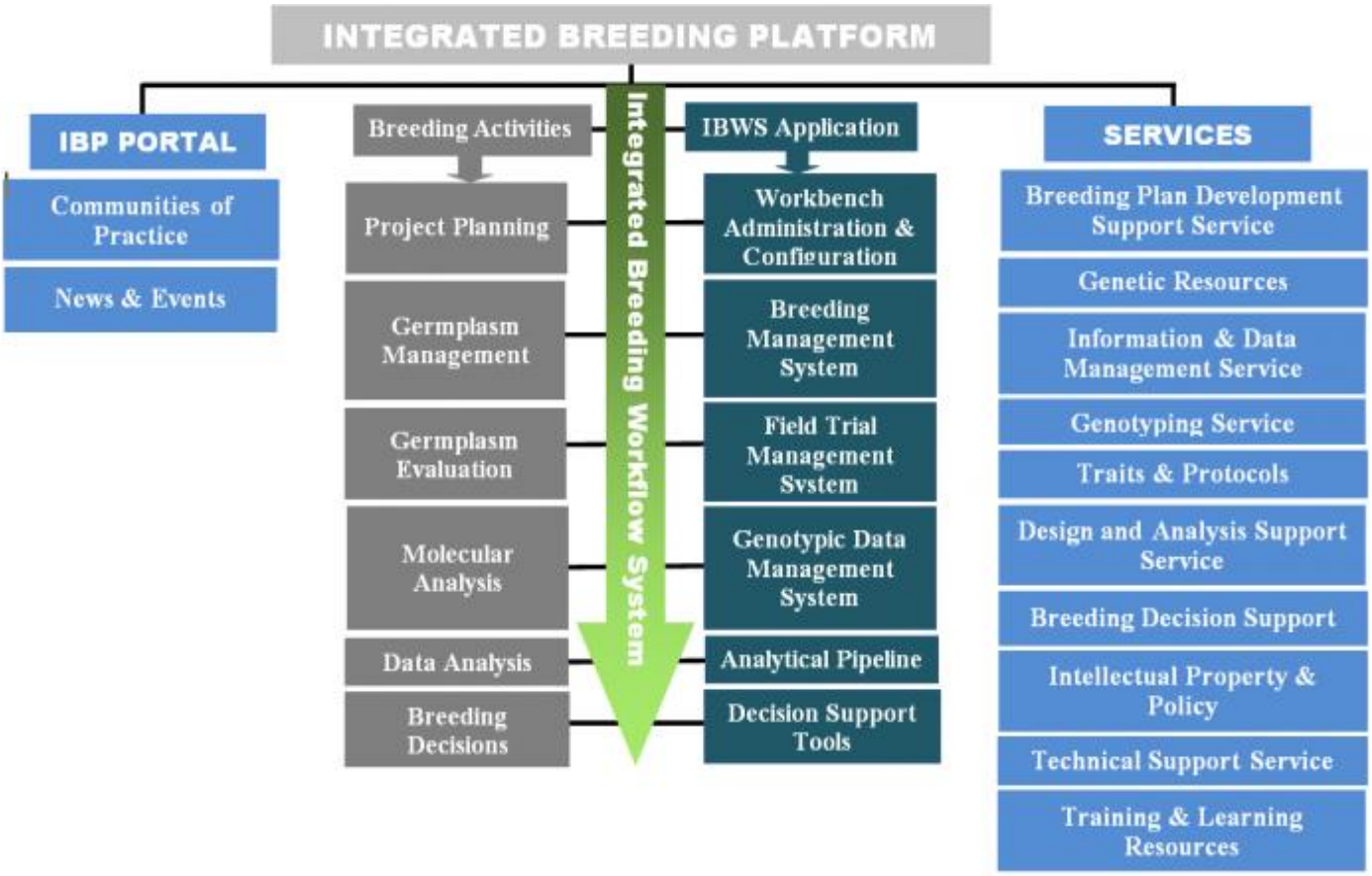
The Integrated Breeding Platform (IBP) is a one-stop-shop where crop breeders can access purpose-built tools to manage plant breeding projects, find new knowledge, access training resources and discuss difficult issues with their peers.

The IBP is particularly intended for developing country crop breeders, to expand their use of proven cutting-edge tools and techniques to improve plant selection and hence food security. It has been developed by a diverse group of partners, coordinated by the Generation Challenge Programme (GCP) of the Consultative Group on International Agricultural Research (CGIAR). The Platform is accessible only to registered users. New users should register through the iPlant Collaborative authentication system which the IBP is utilising for user management. Once registered, use your chosen username and password to log into the IBP Portal.

The IBP is being developed in collaboration with 14 pioneer 'user cases' – breeding projects for eight crops in 32 developing countries in Africa and Asia. For more information on this partnership, click on IBP - A Partnership. A number of breeders, drawn mainly from the use cases, shared their experiences with the nascent platform and their hopes for the same. To read what they have to say, click on pioneer users speak.

Funding for this initiative has been provided by the Bill & Melinda Gates Foundation, the European Commission and the United Kingdom Department for International Development. Click on IBP Core Staff to see the key personnel running the Platform.

**The Platform**



The IBP has three broad components: this web-based portal, an open-source information & data management system comprising of an adaptable Integrated Breeding Workflow System, and Breeding and Support Services offering technical, professional and capacity building support to clients of the platform.

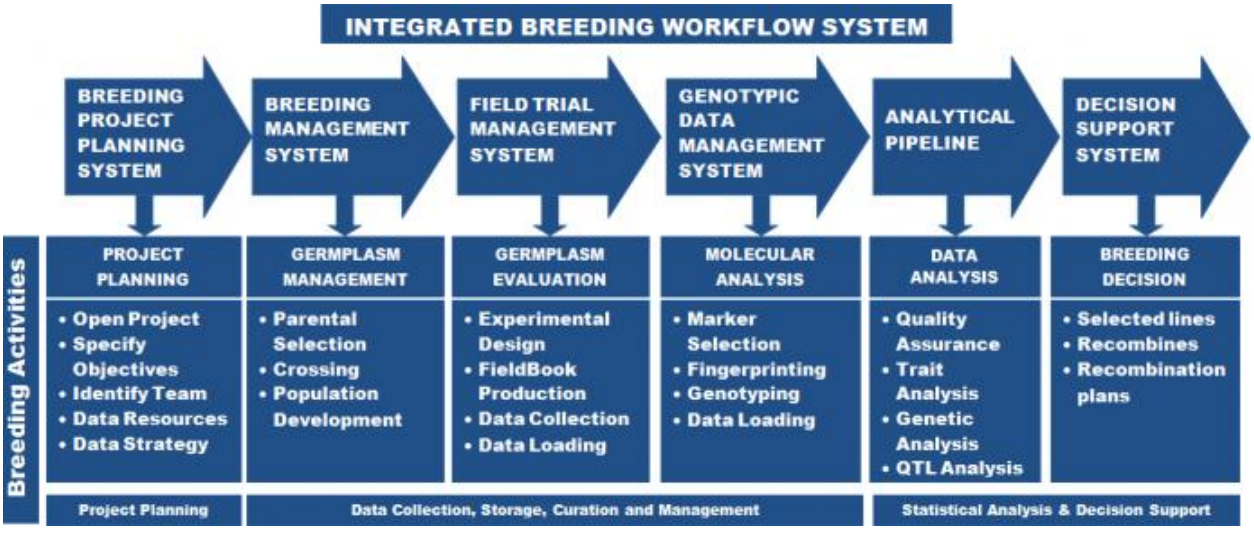
**The IBP Portal**

The portal is the online gateway through which users access and download breeding informatics tools, procure services, access teaching & learning resources, and interact with their peers in various communities of practice. The portal's helpdesks facilitate its use and ensure access for users who cannot efficiently use the web interface, by providing the elements they need via email, CD and other offline media.

***Peer-to-peer support - Communities of Practice and Professional Networks**:* The Platform aims to build vibrant crop-based communities of practice to facilitate mutually beneficial sharing of experiences, information, tools, best practices and improved varieties; while promoting application-oriented and more collaborative research approaches. It provides community-building and interaction facilities for peer-to-peer support and problem solving. IBP staff and designated community members provide technical backstopping and other support to enable registered community members to make blog posts, join various discussion forums, announce their variety releases, access and disseminate publications, and enjoy technical support by posting queries on specific topics.

**The IBP Information & Data Management System**

The centre-piece of the IBP is the Integrated Breeding Workflow System – a consolidated suite of software applications and crop databases specifically designed to help breeders to manage the logistics, data storage, statistical analysis and decision-making for integrated plant breeding. The IBWS comprises of mutually compatible interconnected data capture and quality assurance tools, comprehensive analytical toolboxes, and advanced decision-support tools , ensuring a seamless flow of information. It is customisable for different crops and breeding strategies.

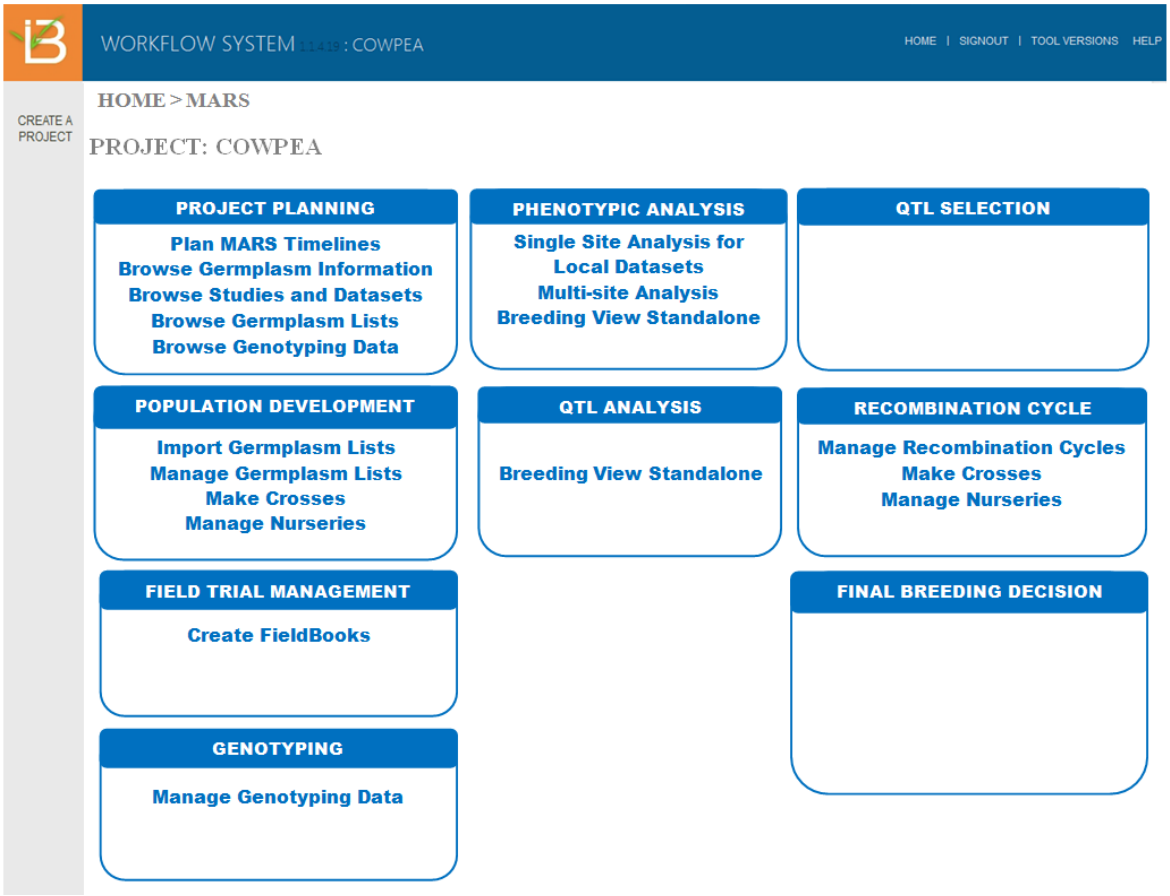



***Obtaining the IBWS:*** Clients can download and install the IBWS from the Integrated Breeding Platform we portal, obtaining everything needed to immediately start using the System. Users can also obtain the IBWS on DVD. The IBWS applications are largely open-source, meaning they can be freely used and modified. However, because they are complex, they are packaged together with customised training and technical support, for which fees may be charged in the future.

***Support for conventional and marker assisted breeding:*** The IBWS supports both traditional (conventional) breeding and modern marker-assisted breeding approaches. It provides step-by-step guidance to users, streamed through four breeding workflows: conventional breeding, marker-assisted selection, marker-assisted recurrent selection and marker-assisted back-crossing. Genome-wide selection will be added in the future. Breeders can also easily modify existing workflows, or create new customised workflows for their specific needs.

***Detailed databases****:* The IBWS provides crop breeding databases with valuable phenotypic, genotypic and pedigree data, including breeder-customised trait dictionaries and molecular marker information. Links to third-party resources provide additional information.

***Tools for all projects and project stages****:* The IBWS provides purpose-built informatics tools for all stages of the crop breeding process**.** These tools support data management, analysis and decision support, and come with user manuals and tutorials. The tools are tailored to support all breeding projects, from the simplest conventional breeding scheme to the most complex marker assisted recurrent selection project. The IBP also provides convenient access to selected third-party tools.




***Project planning:*** The project planning application in the System helps breeders plan and manage projects (ranging from defining project sites to identifying the key skills that team members need).

***Data management:*** Tools in the IBWS data collection and management applications help breeders *manage pedigree and breeding information* (from tracking germplasm samples to managing seed inventories and nurseries); *manage trial and field data* (by creating electronic field books and using tools that make it easier to capture information in databases); and, *manage genotypic data* (for marker selection, diversity analysis, etc)

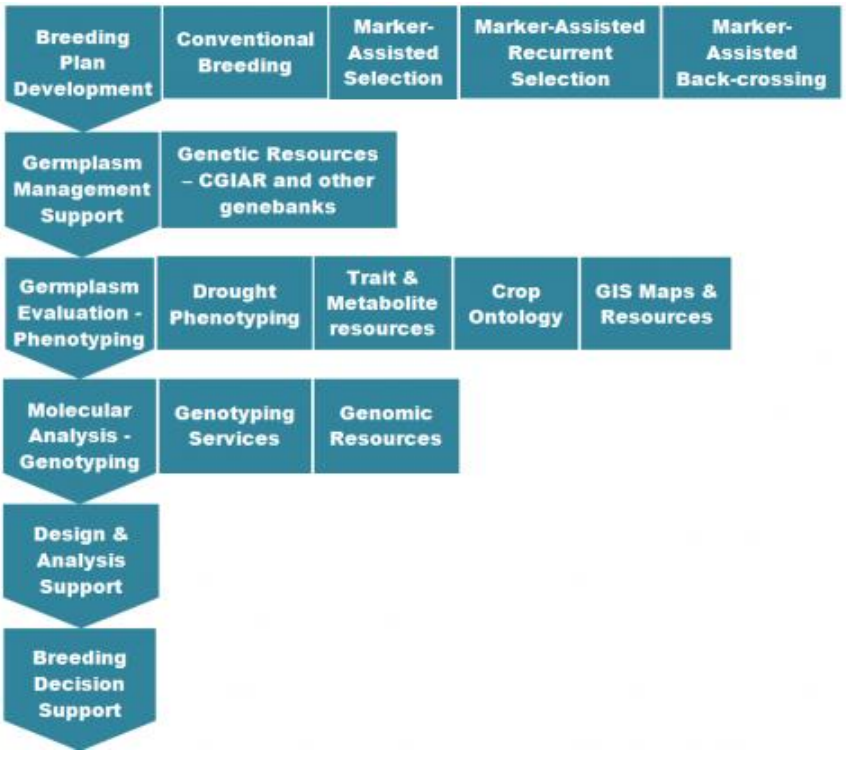
***Analysis and decision support:*** The Analytical Pipeline of the IBWS gives breeders the *statistical analysis tools* that they need to analyse the data that they generate in a breeding or evaluation experiment Breeders can use sophisticated statistical methods to assess progenies and make selections for the next phase of development for the entire spectrum from conventional to advanced molecular breeding. The *breeding decision-support tools* help breeders make quick informed decisions on what material to take forward to the next generation; what plants to cross; what plants to keep, and which ones to discard. These tools handle both simple biparental populations as well as complex multiparental populations.

***Technical and professional support:*** Comprehensive support and capacity building are part of the IBWS package. Efforts are underway to set up regional hubs to optimise this support by bringing it closer to users. Within the IBWS itself, breeders are shown how to access the different project management, data management, statistical analysis and decision-support tools at each stage of their projects. The IBWS guides breeders on when and where to use tools and working protocols – from setting up their experiments to deciding which crosses to make based on the data collected. As a result, even inexperienced breeders using the IBWS can easily plan and proficiently apply internationally recognised modern techniques.

A valuable by-product of using the IBWS will be the accumulation of well-documented, readily accessible, high-quality breeding data and information for integration and publication in publicly accessible databases, contributing to the establishment of a public network of crop breeding information essential for accurate predictive breeding.

**Plant Breeding Services**

The Integrated Breeding Platform provides access to services to facilitate the implementation of various stages of a breeding programme. Through the Platform, clients can obtain services at concessionary fees, including quality high through-put genotyping. Other services are provided in-house, to help with breeding plan development, experiment design, information & data management, data analysis, and integrated breeding in general. Platform staff also answer queries posted on the blogs and forums in the crop community pages.




**Capacity Development**

The Integrated Breeding Platform provides capacity building interventions designed to promote the adoption and efficacious use of modern integrated breeding approaches to cost-effectively hasten the development sand release of improved crop varieties that are more productive and more resilient.

***Training courses****:* The Integrated Breeding Multi-Year Course (IB-MYC) and other programmes provide skills-based training that addresses the practical needs of breeders, data managers, technicians

and field station managers in Sub-Saharan Africa and South & South East Asia. IB-MYC training covers molecular breeding, data management, and analysis.

***Learning resources:*** Clients can access useful in-house learning resources covering a variety of areas, including marker-assisted breeding, phenotyping, genomics & comparative genomics and genebank management. Access to third-party teaching and resources is also provided, many through memoranda of understanding that are beneficial to clients of the IBP.

**The Future**

The Integrated Breeding Workflow System was launched in June 2013, and is undergoing expanded user testing in actual breeding projects. Based on feedback received, enhanced versions will be released in December 2013 and June 2014, with a full commercial-grade version scheduled for release in December 2014.

The Integrated Breeding Platform will continue after the pre-destined closure of GCP in December 2014, with full technical and professional support for continuing and new users. As part of this, the Platform will engage closely with the private sector through structured partnerships designed to take advantage of that sector's acknowledged strengths in product delivery and client support. Regional hubs are also being established to support the roll-out, adoption and use of the IBWS and the Platform as a whole, and will be an integral part of the Platform after GCP closes in 2014.

Up to December 2014, all the tools will be available free of charge to all users. Although a certain level of public funding is expected to continue, providing a consolidated package of tools, training and professional and technical support is costly; and from 2015, users will be charged affordable, graduated fees that will take into account their particular circumstances.

Discussions on the future institutional, governance and management arrangements for the Platform are proceeding in earnest, involving all key stakeholders.