Genetic Resources

Genetic resources are essential for plant breeding. They have long been used and moved around the world in many different breeding programmes. Most genetic resources used in breeding are modern varieties; only a minority are wild relatives or landraces.

Among breeders there is a long standing tradition of not restricting access for breeding purposes to commercialised varieties that are just protected by plant breeders' rights.

Despite a common misconception, patents or plant breeder's rights are not issued for varieties that are already known or for resources that are simply found in nature. Breeders are committed to conserve, exchange, and sustainably use the world's plant genetic resources, and support public conservation initiatives such as the Global Crop Diversity Trust.

Benefits of Breeding

Breeders contribute to the improvement of crops by continuing to create better adapted varieties that perform well under local growing conditions and ever changing farming practices. For example, the yield improvement in wheat due to breeding is estimated at 0.5% per year. These annual yield increases contribute significantly to the economy by increasing farmers' income, lowering food prices, and relieving pressure on the need for cultivated land. Improvements in disease resistance provide better and often cheaper pest and disease management for the most important food and feed crops.

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Breeding Better Varieties

The Value of Plant Breeding and Genetic Resources in Agriculture

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Plant Breeding Explained

Plant breeding refers to the selection of a unique combination of desirable traits within the genetic variation of a plant species, created by crossing plants from different origins, that can be reproduced in a stable fashion in order to secure higher yields, improved quality, disease resistance, etc.

Selecting the best plants is no simple task. Many useful characteristics, such as yield and quality, are controlled by the interaction of a very large number of genes, most of which are not specifically identified. Plant breeding is a global activity in which many breeders from many different countries - including developing countries - are involved.

Methods & Resources

Traditional breeding techniques aim to increase genetic variability mainly through repeated cycles of combining various varieties of different origin. Subsequently, the breeder selects those plants that exhibit the desired combination of traits to compose a new "pipeline variety" for testing in field or greenhouse trials. In this process, these varieties are tested in at least 3-4 replications per trial on several locations in different soil and climatic conditions and for a number of years. Data from hundreds of field plots will be compared before seed production of the best pipeline varieties takes place. Often seed of more varieties will be produced than can be commercialised – on average, only 1 out of several hundred pipeline varieties will be selected for production, and then only 1 out of 4 of these produced varieties will be commercialised.

Wheat: The Story of a Diverse Pedigree

Development of one plant variety involves a number of international genetic resources to be successful. Each one of these genetic resources is intrinsically linked and cannot be simply separated by donor and user. The variety of wheat depicted to the right is bred crossing many different genetic resources from over a dozen countries.

The outcome of these crossings is not predictable due to the diversity resulting from the recombination of thousands of genes. The breeder's job is to identify the most promising plants from the tens of thousands of variants.

In this process the breeder eliminates many plants because they fail to meet the criteria for qualities such as: improved yield, cold hardiness, and resistances against rust, mildew, virus, and other diseases. Successful breeding requires good trial sites, laboratory facilities, seed storage, and computers for the processing of vast amounts of data. The infusion of new genetic resources is important, but it can only occur at the very beginning of a long, tedious and costly breeding process; and the exotic nature of these introduced resources makes their inclusion an even more time-consuming and uncertain business.

Without facilitated access to genetic resources, plant breeders will find it difficult to continue to develop new varieties which can meet the demands of a growing world population.

The Breeding Process

1. **TRAIT DISCOVERY** — **Mid 1980s**
   A period of pre-breeding-crossing in scab resistance from an exotic source that performs and yields poorly to develop resistant lines with performance attributes up to minimum standards that can then be introduced into the breeding programme.

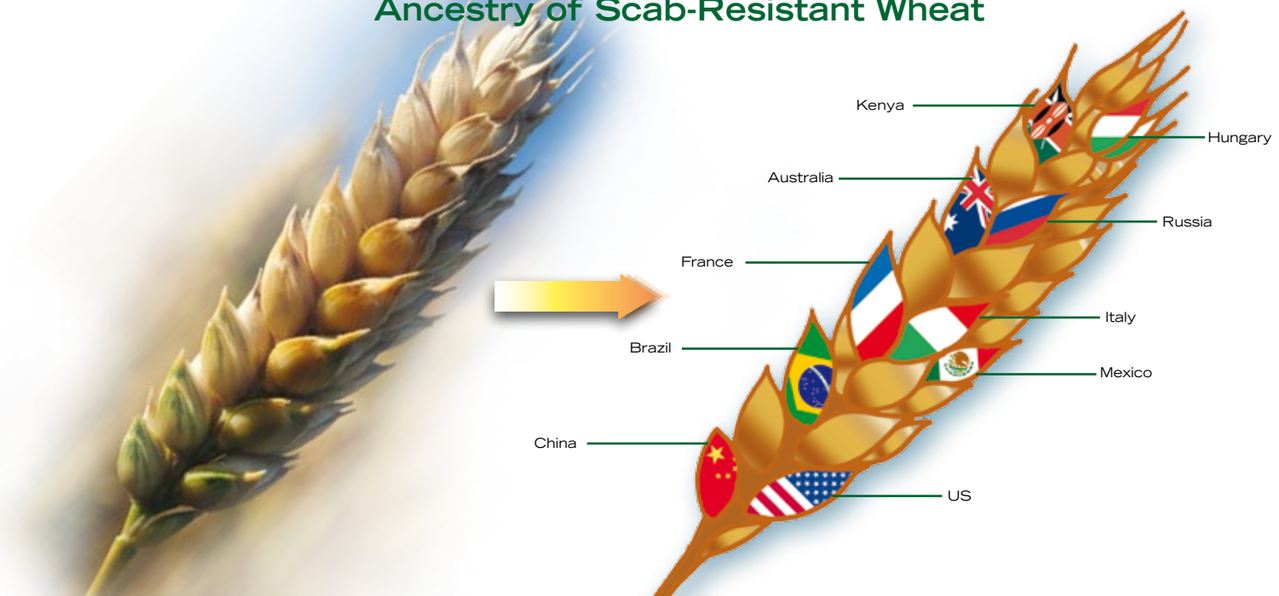
2. **DEVELOPMENT** — **1995 - 1998**
   First parental cross made; 1st Generation grown in a transplant nursery. Bulk populations created and initial selections of 2nd and 3rd generations made.

3. **SELECTING FOR DISEASE RESISTANCE** — **1998-1999**
   4th and 5th Generation plants from the selected row were evaluated for resistance to Fusarium head blight.

4. **SELECTING FOR MAXIMUM YIELD** — **1999-2006**
   Yield testing with the 6th -12th Generations

5. **COMMERCIALISATION** — **Fall 2006**
   Wheat variety available for first commercial sales in the autumn of 2006.

Ancestry of Scab-Resistant Wheat



Case Study: Wheat Disease Resistance Development

The timeline for development shown on the left illustrates a wheat breeding programme which resulted in a wheat variety with a high yield and resistance to "wheat scab," a disease caused by the fungus, Fusarium. Scab's appearance is indicated by bleached white wheat heads in fields that should be green. Scab can cause the appearance of toxins and significantly diminish yields.

Scab-infected wheat is recognisable by the premature bleaching of one or more spikelets on a head.

Facilitated Access is Key for New Genetic Resources

Breeders will be encouraged to utilise new genetic material only if there is a practical, simple and legally secure system of accessing plant genetic resources. Breeders cannot afford to spend time and resources in negotiations that result in unclear or ill-defined terms, because the contributed value, if any, of the material accessed will only be realised after many years of plant breeding. Breeders support a multinational system or a national system with one authority that grants permission for breeders to access genetic resources possibly through authorised gene banks or public institutes on clear internationally harmonised terms for benefit sharing.