Valorisation of cotton germplasm collections, securing and developing exchanges in compliance with international agreements

Christopher VIOU, Najate MAGHNAOUI, Claire NERAC, Dominique DESSAUW, Bruno BACHELIER

Earth Summit in Rio de Janeiro
Adopted on 5 June 1992
Entered into force on 29 Dec. 1993
Multilateral treaty
195 States and the European Union
Convention on Biological Diversity - CBD
1992
- Three main goals:
  - conservation of biological diversity
  - sustainable use of its components
  - fair and equitable sharing of benefits arising from genetic resources

- Genetic resources under the jurisdiction and sovereignty of national governments
- Regulated access to genetic resources and associated traditional knowledge
- All forms of life

COTTON GERMPLASM EXCHANGES

International Union for the Protection of New Varieties of Plants UPOV

Phytosanitary regulations

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Phytosanitary measures

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Cotton genetic resources present an enormous potential for varietal improvement, but they are nevertheless insufficiently exploited.

How could the use of cotton genetic resources in varietal improvement be intensified?

or

What restricts the use of cotton genetic resources and their use in crop improvement?

How could we facilitate and what restricts the use of cotton genetic resources in varietal improvement?

We can put forward different points about international exchanges of cotton germplasm and breeding:

- Improvement of cotton seeds: many new genes in response to climate change and agronomic challenges
- No country is self-sufficient in genetic resources (very big gene banks help for self-sufficiency, of course)
- In the last decade, there have been marked evolutions of the available tools for exploration of the genetic resources and their valorization in varietal improvement, including new tools, dropping costs, high-throughput instruments, concerning:
  - Genotyping with DNA marker
  - Genome sequencing
  - Phenotyping
  - Bioinformatics
  - Mathematical tools
  - Genome-editing tools
  - Annotated cotton genome sequences
- Exploration of the genetic resources must be intensified
- International exchanges of germplasm are mandatory
- Not all genetic variation is available in gene banks:
  - Natural populations of wild or feral (domesticated returned to wild) cottons
  - Traditional varieties and landraces, either still cultivated or maintained in gene banks
  - Breeders' collections in cotton-producing countries: can include modern but also obsolete varieties and landraces
- In situ and ex situ gene banks (seeds mainly)
- Efforts of countries and private companies with more scientific and economic power can easily take advantage of an access to genetic resources
- Important potential for breeding: easy access to modern improved germplasm, genes for stress resistance, local adaptation and diverse adaptive traits, and, more generally, genetic diversity that was lost during recent intense selection.
- Major importance: permit conservation, evaluation and regulated exchanges of numerous well-identified genotypes
- Previous genetic diversity: great resistance, pest resistance, fiber quality - but more or less difficult gene search and very slow gene transfer by traditional breeding methods, although possibly easier and faster through new genomic technologies

Countries and private companies with more scientific and economic power can easily take advantage of an access to genetic resources. There is legitimate fear by original owners of the genetic resources to be left out of part of the benefits arising from the discovered genes or genetic information. It could, in this case, be nearly impossible to relate innovation and genetic resources.

Many small cotton-producing countries with genetic resources, in particular wild/feral populations, or other collections, do not have scientific facilities or qualified staff for gene search.
Populations of wild cotton plants, that are not characterized and specifically protected, can find themselves in danger of disappearing because of habitat alteration or destruction (mainly caused by man, but also by current rapid climate change).

Genetic resources comprised of traditional varieties are today much jeopardized by modernization of agriculture and social evolution. There is an urgent need to develop collecting projects as well as in situ and ex situ conservation.

Excessive constraints to research on genetic resources can be very detrimental to their valorization and even protection.

How could we facilitate and what restricts the use of cotton genetic resources in varietal improvement?

Genetic resources collecting, genetic and phenotypic characterization, conservation and protection, have a rather high cost and imply qualified staff.

There must be sufficient financial return from commercial successes towards the institutions managing genetic resources.

Genetic resources that are not studied or can’t be studied, are of little use for varietal improvement.

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Homozygosity of plant descriptors

Cotton collection descriptors exist, such as those of UPOV, Bioversity International, GRIN and the systems of descriptors used by the different gene banks, breeders, taxonomists, and other genetic resources users and specialists. Establishing a uniform system of plant descriptors would probably not be such a long and difficult task.

DNA markers are much more potent than morphological plant descriptors for the identification of genotypes; genotyping would permit to find duplicates, assess the existing diversity, elaborate core-collections. Agreeing on which markers are most appropriate will probably not be straightforward, but it’ll be worth the effort.

Two objectives appear as particularly important for coordinating activities on cotton genetic resources:

- Uniform plant descriptors and common sets of DNA markers.

It could permit to initiate a network between cotton collections worldwide.

Cirad’s strategy on cotton genetic resources and varietal improvement

CIRAD: a French research institution dedicated to International Cooperation in Agonomic Research for Development.

CIRAD has professionalized the management of its genetic resources: integration in the Tropical Biological Resources Center - CRBt (Montpellier, France), with modern facilities, specialized researchers and technical staff, including juridical experts; it is ISO certified.

CIRAD maintains a cotton gene bank, created initially by cotton geneticists such as Jacques Schwendiman. Description of the genotypes is rather complete. Interactions with all types of users and institutions worldwide.

Transfer of competences to national agronomic research systems in many countries.

Seed transfers to national agronomic research systems in many countries.

Backup of cotton genetic improvement programs.

Many thanks for your attention.