RESEARCH AT A GLANCE

Biotechnology and Genetic Resource Policies

What Is a Genebank Worth?

Brief 12

THE DEMAND FOR CROP GENETIC RESOURCES FROM INTERNATIONAL COLLECTIONS

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It is commonly known that most major agricultural crops were domesticated over a period of a thousand years in what are now termed "developing" countries of the "South." Path-breaking conservationists such as Vavilov (1926) and Harlan (1975) have documented the great genetic diversity found in these countries. There is little doubt that the flow of crop genetic resources from developing countries to Europe and North America provided much of the biological foundation for agriculture in today's developed countries (Fowler 1994).

However, comparatively less attention has been given to the patterns of more recent flows of genetic resources. It is suggested that recent flows of genetic resources are generally directed at crop improvement, where as historical transfers were often aimed at crop introduction. While acknowledging the significance of historical patterns, this study provides a snapshot of more recent flows enabled through the centers of the Consultative Group on International Agricultural Research (CGIAR). Data sources for the analysis include the International Maize and Wheat Improvement Center (CIMMYT), the System-wide Information Network for Genetic Resources (SINGER), and a set of case studies for 15 developing countries from 1972 to 1991.

The CGIAR is the largest consortium of crop-oriented research facilities in the world, concentrating on major crops of importance to world food security. The germplasm held "in trust" at the genebanks in the CGIAR remains part of the "public domain." Landraces make up a substantially larger portion of the CGIAR collections (59 percent) than they do in national (12 percent) or private (9 percent) collections (FAO 1998). Experts generally agree that for highly bred crops such as wheat and rice, much of the breadth of the gene pool is represented by samples held in genebanks (FAO 1998), with only a few pockets of diversity remaining in farmers' fields. Countries in what is known as the Vavilovian centers of origin are no longer the principal suppliers of such materials, and some areas ceased filling this role decades ago. In some sense, the genebank has become a modern-day "center of diversity."

Data from detailed case studies for 15 developing countries reveal that the number of germplasm samples received from the CGIAR collections were many times more than they contributed to the collection over the period 1972–1991. Although this is the time period in which the greatest outflow of genetic resources from developing countries took place during collection missions, the countries in these studies clearly received more of samples than they contributed (Table 1, next page). The 15 countries were net recipients of germplasm during the two decades in all crop categories except roots and tubers.

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Table 1—Flow of germplasm between less developed countries (LDCs) and CGIAR genebanks, from 1972 to 1991

Crop Category	LDCs → CGIAR genebanks	CGIAR genebanks → LDCs
	(number of samples)	
Cereals	63,479	247,386
Roots and tubers	17,726	15,470
Legumes and pulses	33,031	202,130
Vegetables	2,712	47,502
Forages	7,381	16,928
All crops	***124,329***	***529,416***

Source: Fowler, Smale, and Gaiji 2001.

Note: LDCs include Chile, Colombia, India, Indonesia, Kenya, Madagascar, Pakistan, Peru, Philippines, Rwanda, Saudi Arabia, Syria, Tanzania, Uruguay, and Zimbabwe.

Subsequent analysis of records amassed over the past 28 years of samples of key crops from six of the CGIAR centers (CIAT, CIMMYT, ICARDA, ICRISAT, ILRI, and IRRI) shows that more than 80 percent of the materials distributed by genebanks, which totaled about one million samples, went to organizations in developing countries, the vast majority being universities and national agricultural research systems (SINGER, singer.cgiar.org). Nearly three-quarters of the material that had originated from developing countries flowed back to those countries. Developing countries that requested the same material were furnished an average of four times per accession (as opposed to twice per accession for developed countries), indicating the important service of the genebanks to their national agricultural research needs.

Although germplasm transfers from genebanks at CGIAR centers are significant in terms of both volume and value to breeding programs, the transfers of breeding lines through their nurseries are much greater both numerically and, most likely, in terms of economic importance. These breeding lines help to reduce the costs of national crop improvement programs, speed up the varietal development and release, and broaden the pool of materials accessible to scientists. For the past few decades, the productivity gains stimulated by germplasm exchanges through the CGIAR have been large, although unevenly distributed across crops, regions, and time periods (Evenson and Gollin 2003).

This international exchange of germplasm has increased the likelihood of introducing new materials to the genealogies of a variety, although often the genetic contribution of any particular landrace is small. For example, of the 1,162 spring bread wheat cultivars released by developing countries from 1965 to 1997, an estimated 87 percent had at least one CIMMYT progenitor (Smale et al. 2002). Measured by either genealogical or molecular indicators, the genetic diversity of major CIMMYT progenitors has increased over the past three decades. Because national programs in developing countries cross CIMMYT lines with their own materials before releasing them, the genetic diversity of their cultivars is at least as great as that present among CIMMYT lines. Heisey, Lantican, and Dubin (1999) have estimated that for an annual investment of only $100 million to $150 million, the international wheat breeding system produces annual benefits ranging from $1.6 billion to $6 billion or more, in 1990 U.S. dollars. The size of benefits depends on how the credit for yield gains is distributed between yield gains and crop management practices and on numerous other economic and technical assumptions.

The transactions costs involved in negotiating bilateral access for all of these transfers would have been enormous, and it is suggested that a multilateral system would likely reduce transactions costs of exchanging major food crops. Minor food crops with limited exchange and less complex negotiations may be amenable to bilateral arrangements, but the lack of sizable commercial seed markets may also limit transaction of these crops. Bilateral transaction costs may be acceptable only for a very restricted number of industrial, medicinal, and ornamental crops (Visser et al. 2003). Transactions costs are only one component of a wider set of opportunity costs involved in the exchange of genetic resources, such as the benefits missed through reduced access to diverse materials in breeding and research.

The recently agreed International Treaty on Plant Genetic Resources for Food and Agriculture will help facilitate access to genebank accessions for the 35 crops (and crop complexes) and forage crops with a multilateral system. However, the treaty contains some ambiguities, and many questions still need to be resolved to achieve its objectives. First, some major crops such as soybeans and groundnuts are excluded from the list of crops that are subject to the multilateral system of transaction. There is also a lack of consensus regarding the meaning of "equitable" benefit sharing, the magnitude of benefits derived from the use of shared germplasm, and the methodology of estimating the benefits (Day-Rubenstein and Heisey 2003).

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For more detailed information see

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