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Access to plant genetic resources for genomic research for the poor: from global policies to target-oriented rules

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Abstract
Applied genetics combined with practical plant breeding is a powerful tool in agricultural development and for food security. The Green Revolution spurred the world's potential to meet its food, feed and fibre needs at a time when vast regions were notoriously food-insecure. Subsequent adaptations of such strategies, from the late 1980s onwards, in order to develop new plant varieties in a more participatory way, have strengthened the focus on applying technology to farmers' diverse needs, feeding research results into a variety of seed systems. During these developments, there were no major legal impediments to the acquisition of either local or formal knowledge or of the building blocks of plant breeding: genetic resources. The emergence of molecular biology in plant science is creating a wealth of opportunities, both to understand better the limitations of crop production and to use a much wider array of genetic diversity in crop improvement. This 'Gene Revolution' needs to incorporate the lessons from the Green Revolution in order to reach its target groups. However, the policy environment has changed. Access to technologies is complicated by the spread of private rights (intellectual property rights), and access to genetic resources by new national access laws. Policies on access to genetic resources have changed from the concept of the 'Heritage of Mankind' for use for the benefit of all mankind to 'National Sovereignty', based on the Convention on Biological Diversity, for negotiated benefit-sharing between a provider and a user. The Generation Challenge Programme intends to use genomic techniques to identify and use characteristics that are of value to the resource-poor, and is looking for ways to promote freedom-to-operate for plant breeding technologies and materials. Biodiversity provides the basis for the effective use of these genomic techniques. National access regulations usually apply to all biodiversity indiscriminately and may cause obstacles or delays in the use of genetic resources in agriculture. Different policies are being developed in different regions. Some emphasize benefit-sharing, and limit access in order to implement this (the 'African Model Law'), while others, in recognition of countries' interdependence, provide for facilitated access to all genetic resources under the jurisdiction of countries in the region (the Nordic Region). There are good reasons why the use of agricultural

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biodiversity needs to be regulated differently from industrial uses of biodiversity. The International Treaty on Plant Genetic Resources for Food and Agriculture, which entered into force in 2004, provides for facilitated access to agricultural genetic resources, at least for the crops that are included in the Treaty's 'Multilateral System of Access and Benefit-sharing'. Ratification of the Treaty is proceeding apace, and negotiations have entered a critical stage in the development of practical instruments for its implementation. Although the scope of the Treaty is all plant genetic resources for food and agriculture, there are important crops that are not covered by its Multilateral System. Humanitarian licences are being used to provide access for the poor to protected technologies: countries may need to create such a general humanitarian access regime, to ensure the poor have the access they need to agricultural genetic resources.

Keywords: access and benefit-sharing; genomic research; intellectual property rights; International Treaty; plant genetic resources

Introduction

Applied genetics combined with practical plant breeding is a powerful tool in agricultural development and for food security. The Green Revolution spurred the world's potential to meet its food, feed and fibre needs at a time when vast regions were notoriously food-insecure (Borlaug, 1970), but had some limitations as well. Subsequent adaptations of such strategies, from the late 1980s onwards, in order to develop new plant varieties in a more participatory way, have strengthened the focus on applying technology to farmers' diverse needs, feeding research results into a variety of seed systems (Louwaars and van Marrewijk, 1996; David and Sperling, 1999). During these developments, there were no major legal impediments to the acquisition of either local or formal knowledge or of the building blocks of plant breeding: genetic resources.

Despite the great advances, hunger, malnutrition and poverty are still widespread today. The problems that arose with the Green Revolution have been attributed to the varying success of the new varieties among farmers in different ecological regions and of different wealth and power (Lipton and Longhurst, 1989), as well as to problems in the distribution of food (Shiva, 1991). However, a major achievement of the Green Revolution was an increased per capita food availability of nearly a third in Asia between 1970 and 1995, despite a 60% population growth (Hazell, 2002). The need has been recognized to link agricultural development to sustainability (Conway and Barbier, 1990; Conway, 1997). More recently, the issue of global food security is again drawing attention, after having been low on the global agenda for over a decade (McCalla and Revoredo, 2001).

The challenges presented in the Millennium Development Goals (MDGs; see http://www.un.org/millenniumgoals/), and the Millennium Ecosystems Assessment (MEA, 2005) comes at the time of unprecedented technological development in the biosciences (FAO, 2004). Genomic techniques create opportunities to understand better the individual characteristics of crop plants and provide tools to use this knowledge for more effective and increasingly efficient plant breeding. Agricultural research, and more specifically crop improvement, therefore has the potential to contribute greatly to achieving the MDGs. Within this context, genetic improvements that provide increases in production, yield stability and the nutritional content of food products can contribute significantly to local food security and poverty alleviation (FAO, 2002). The MEA stresses the need to reduce the over-exploitation of natural resources, providing parameters and boundaries for ecological sustainability, and is a further reason for improving agricultural development.

As in the Green Revolution, the relevant technologies are mainly developed in industrial countries in the North, and specific initiatives are needed to apply these in the South for development purposes. The increased physical distance between the developers of the enabling technologies (in their laboratories in the North) and the environmental and social reality of the poor increases risks of disconnection. Reference to the Green Revolution regularly is made when speaking about the promises of molecular biology in plant breeding. However, the terms 'Gene Revolution' (Swaminathan, 1999) and 'biotechnology revolution' (Conway, 2003) are explicitly not used to mean the simple repetition of the approaches of the Green Revolution, but a more careful application of technology in research for development. The Generation Challenge Programme is a research consortium that aims to apply genomic techniques to identify important stress responses in plants, in particular drought tolerance, and make these available for crop improvement programmes directed at the needs of the resource-poor (see http://www.generationcp.org).

The political environment for research has, however, also changed dramatically (Petit *et al.*, 2000). A key difference between the Gene and the Green Revolutions is the fact that a number of the basic biotechnologies for the Gene Revolution were developed, or acquired, by the private sector. The scientific knowledge which formed the basis of the Green Revolution, on the other hand, was publicly available, and the results of research were public goods that could be freely shared, among countries and with farmers. The application of privately owned biotechnologies in research for development poses specific challenges for scientists' freedom to operate. Special licences may be required to access patented technologies, materials and processes. An impact study on these intellectual property rights (IPRs) in breeding in developing countries provides evidence that countries need to construct their IPR laws and implementation mechanisms with great care (Louwaars *et al.*, 2005).

In addition to the strengthening of IPRs, their growing role in the biological sciences, and their spread from industrialized countries to other parts of the world, there have also been changes in the appreciation of the importance of genetic resources in the period between the Green and the Gene Revolution. Partly as a result, international and national policies on access to genetic resources and benefit-sharing have created additional freedom-to-operate issues during this period.

This paper investigates current obstacles to access to genetic resources for agricultural research for development, and offers some options for reducing the effect that these may have on their sustainable use in plant breeding, in order to meet global challenges. It is based on presentations and discussions on policy issues during the first International Conference on Genomics-based Plant Germplasm Research, Beijing, China, 25–28 April 2005.

Access to plant genetic resources: historical perspective

Genetic resources have been exchanged within and among farming communities since the origin of agriculture some 10,000 years ago. Farmer selection and the exchange of seeds and planting materials between farmers were the basis of the domestication of crops and the development of landraces and farmers' varieties. The free availability of all genetic resources as a resource for further breeding was also basic to the IPR systems that emerged in a number of industrialized countries in the first half of the 20th century, and later to internationally harmonized Plant Variety Protection systems.

The 'enormous contribution that farmers of all regions have made to the conservation and development of plant genetic resources, which constitute the basis of plant production throughout the world' was internationally recognized in the voluntary International Undertaking on Plant Genetic Resources (see http://www.fao.org/ag/cgrfa/IU.htm), which was developed under the auspices of the FAO Commission on Genetic Resources for Food and Agriculture in the 1980s. This was the basis of Farmers' Rights, 'vested in the International Community, as trustee for present and future generations of farmers, for the purpose of ensuring full benefits to farmers, and supporting the continuation of their contributions'. Plant genetic resources were originally seen as a 'heritage of mankind [which] consequently should be available without restriction'. In 1991, the Undertaking recognized that 'the concept of mankind's heritage, as applied in the International Undertaking on Plant Genetic Resources, [was] subject to the sovereignty of the states over their plant genetic resources'. The concept of 'heritage of mankind' was challenged in subsequent years by two separate developments: policy discussions in the environmental and in the trade forums, and technological developments in the science of molecular biology. The agricultural sector was not immediately involved in these international developments.

The debate in the environmental sector culminated in the 1992 Rio de Janeiro UN Conference on the Environment and Development (UNCED). A chapter of the so-called Agenda 21 dealt with biodiversity. Through the Convention on Biological Diversity (CBD; 1993), biodiversity became a natural resource that could in effect be traded. Biological Diversity includes all living matter, including natural and agricultural species. While, under the CBD, Parties have the responsibility to conserve biodiversity and promote its sustainable use, they may restrict access to genetic resources and make this subject to a contract that provides for prior informed consent and bilateral benefit-sharing. Such bilateral access arrangements are not required by the CBD, but this is how most countries have chosen to exercise their sovereignty. The CBD thus explicitly overrode the 'heritage of mankind' principle. The result is that transfers of genetic resources are most often accompanied by individually negotiated contracts, with contractual obligations on the recipient. This had led, for example, to the signing of Material Transfer Agreements (MTAs) by farmers who participate in participatory breeding initiatives in the Philippines that use materials from the national rice institute PhilRice (Salazar *et al.*, 2006).

The debate in the trade sector led to the Marrakesh agreement, the establishment of the World Trade Organization (WTO) and the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS). The TRIPS Agreement specifies minimum standards for IPRs in the territories of member countries of the WTO territory. TRIPS requires that all products and processes must be patentable with, according to Article 27(3), the possible exception of 'diagnostic, therapeutic and surgical methods for the treatment of humans or animals' and 'plants and animals other than micro-organisms, and essentially biological processes for the production of plants or animals other than non-biological and microbiological processes', provided that plant varieties are protected by 'patents, or by an effective *sui generis* system, or by a combination thereof'. The individual rights conferred by IPR may restrict the free availability of genetic resources. In this, TRIPS also breaks with the 'heritage of mankind' principle. However, current *sui generis* plant variety protection, such as those national systems that are compliant with one of the Conventions of the International Union for the Protection of New Varieties of Plants (UPOV), do provide for the free availability of all materials, including protected varieties, for further breeding (the so-called 'breeder's exemption'). This is, however, different when varieties are protected by utility patents, as is common in the USA.

Recent scientific developments in molecular biology create spectacular opportunities for making plant breeding more efficient and more effective. However, the early inventions were made with micro-organisms in the USA. These were subject to industrial uses and patent applications under the industrial (utility) patent system were accepted by the US Patent Office and confirmed by American judges. When such molecular biological techniques were applied to crop plants, this policy was maintained, and other industrial countries to a large extent followed the US example. Since the research exemption within the patent system in the USA is restricted to research purely to understand how the product was made, and excludes any research that could lead to further uses, the system is very restrictive of the availability of genetic resources, where they (or a component, such as a gene) have been patented. The emergence of molecular biology thus introduced an important policy aspect into the field of plant breeding.

As a result of these developments on IPRs, discussions started in the late 1970s on additional rights systems that could balance the corporate IPRs (Mooney, 1979). These early discussions contributed to the debate on Farmers' Rights and rights on indigenous knowledge, which in turn contributed to the establishment of the Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge, Genetic Resources and Folklore (IGC; http://www.wipo.int/tk/en) under the auspices of the World Intellectual Property Organization (WIPO) in 2000.

The unique character of agricultural biodiversity

The environmental and trade negotiations did not specifically target genetic resources for food and agriculture, and made no special provisions for them that took into account their unique nature (Esquinas, 2005).

Genetic resources for agriculture are categorically different from wild genetic resources, for a number of reasons (Stannard *et al.*, 2004).

(i) They are essentially *man-made*, that is, they have been consciously developed and selected by farmers since the origins of agriculture, 10,000 years ago. Much of the genetic diversity of cultivated plants can only survive through continued human conservation and maintenance. Scientific plant breeders have built upon this rich inheritance for little more than a century. The complex pedigrees of most improved varieties resulting, from such scientific plant breeding programmes, complicate attempts to trace specific genes, and to infer their possible relative values.

(ii) They are not randomly distributed throughout the world, but to some extent concentrated in the so-called 'centres of origin and diversity' of cultivated plants and their wild relatives, which are largely located in tropical and sub-tropical areas (Vavilov, 1951; Harlan and de Wet, 1971).

(iii) Because of the diffusion of agriculture throughout the world, and because of the association of major crops with the spread of civilizations, many crop genes, genotypes and populations have spread, and continued their development in farmers' seed systems all over the planet (Almekinders *et al.*, 1994), so enriching the crop gene pool by adaptation to a wide variety of agro-ecosystems. Moreover, plant genetic resources for food and agriculture have been systematically and freely collected and exchanged until recently, and a large proportion has been incorporated in *ex situ* collections. This means that the origin of an unknown genetic resource can often not be established, and that it is thus not clear who may be responsible for granting access.

(iv) There is much greater interdependence among countries for plant genetic resources for food and agriculture than for any other kind of biodiversity (Flores Palacios, 1997). Continued agricultural progress implies the need for continued access to the global stock of plant genetic resources for food and agriculture. No region can afford to be isolated, or isolate itself, from the genetic diversity of other parts of the world (Smale and Day-Rubinstein, 2002). Even a diversity-rich country like China depends on foreign germplasm, both at the species level (important crops like cotton, maize, groundnut, and many fruits and vegetables) and at the level of foreign varieties of old crops in the country (such as rice materials from Nongken 58 from Japan, IR8 from the International Rice Research Institute and highland rice from Brazil), as well as for parents for Chinese breeding (such as the wheat variety Orofen, which is included in the pedigree of 245 released varieties in China (Shumin Wang, personal communication).

Agricultural genetic resources and patents

For similar reasons, there are many problems in applying patents to agricultural genetic resources, even though they are man-made, and were developed collectively by groups of farmers and their communities over millennia. Compared to inventions in the inanimate world, new plant varieties are commonly:

(i) Not innovative, since the way they are produced in normal breeding programmes is well described, and the resulting variety is a combination of the breeder's decisions and stochastic pressures from nature.
(ii) Not reproducible (as an invention): a variety cannot be described in such a way that someone skilled in the art is able to reproduce it. Even if that person were to make a cross between the same parents, it would not be possible to reconstruct the variety.
(iii) Not stable: even with the best maintenance breeding practices, varieties will change due to occasional mutation and introgression. This is most obvious in cross-fertilizing species, but happens also in self-pollinators and in vegetatively propagated crops.
(iv) Protected varieties or traits tend to spread themselves to other fields or farms, either through spillage of seed, or by pollen flow. It is not always possible to point to a human influence in cases of infringement, unless one is to make the licence-holder responsible for containing the protected biological invention, which he cannot (Hardon, 2005).
(v) In biotechnology it is difficult to draw the line between inventions and discoveries, and a key debate is whether a plant should fall within the scope of protection when the function (invention) of a (discovered) gene is unravelled through molecular biology.

Apart from ethical and political (food supply) factors, these practical considerations kept biological inventions outside the scope of the patent system for many decades. They were also the reason for the development of *sui generis* systems, such as the Plant Patent Act (1930) in the USA and Plant Variety Protection in many other countries. Even though molecular biology may provide a more scientific identification of the invention, many of the above arguments are still valid, and legislators and the juridical system have problems demarcating the rights and obligations of patent-holders and users in agriculture. This debate is particularly valid when rights based on patents or *sui generis* systems impact a wide range of genetic resources and not just one genotype, such as is the case with the patent on any yellow-coloured bean, which was granted in the USA, the 'Enola bean case.[1]

Emerging regional policies in Africa and Europe

A wide variety of choices can be made in national law, when governments choose, in the exercise of their sovereign rights, to regulate access to genetic resources, including in relation to IPRs. To illustrate the range of choices, we analyse two examples: the 'African Model Law for the Protection of the Rights of Local Communities, Farmers and Breeders, and for the Regulation of Access to Biological Resources in Relation to International Law and Institutions' of the African Union (in short: the African Model Law; Grain, 2000); and the policies of the Nordic countries with regard to access to genetic resources.

The African Union

The countries of the Organisation of African Unity in 1996 organized a conference on medicinal plants, in which they decided to develop a comprehensive framework for the protection and utilization of Africa's natural plant resources, considering both the CBD and TRIPS. It was one of the first attempts anywhere to translate the obligations from these two agreements in one *sui generis* legal framework. The resulting 'Model Law' is not in itself a legal act, but provides the countries of the African Union with a model for their own national

[1]CGRFA-10/04/Inf.14, 2004 Report on the International Network of Ex Situ Collections Under the Auspices of FAO: further information provided by the International Centre for Tropical Agriculture (CIAT), regarding its request for a re-examination of US patent No. 5,894,079. Document of the FAO Commission on Genetic Resources for Food and Agriculture, ftp://ext-ftp.fao.org/ag/cgrfa/cgrfa10/r10w6e.pdf. See also CGRFA-10/04/6, 2004 Report on the International Network of Ex Situ Collections Under the Auspices of FAO, ftp://ext-ftp.fao.org/ag/cgrfa/cgrfa10/r10w6e.pdf.

regulatory systems. The basic principles underlying the Model Law are derived from the regional focus on food sovereignty and food security, as well as on state sovereignty, and on a range of principles that can also be found in the CBD and TRIPS.

The importance given to genetic resources derives from the recognition that over 90% of the continent's food is produced in farming systems that are highly dependent on agricultural biodiversity, and on farmers' seed systems. On the basis that the State represents the people, and has the responsibility to defend the rights of the people, the Model Law provides that private rights such as IPRs should neither remove national and local control over food production nor the intergenerational rights and obligations of communities over genetic resources. The Model Law recognizes the rights of communities over their biological resources and protects indigenous knowledge. It affirms the importance of community participation in decision-making in matters affecting biological resources and associated knowledge, and invites communities to participate actively in the development of policies, plans, and programmes to implement the Model Law, at national and local levels. This applies in particular to the role of communities in providing access to genetic resources, and in the sharing of the benefits derived from the utilization of these resources.

The authority to provide access to genetic resources rests with national governments. Access should be governed by principles of fairness and equity, i.e. based on prior informed consent (including the written consent of both the state and the community) and on mutually agreed terms, with the benefits being shared in a fair and equitable manner. Access regulation should not unnecessarily restrict traditional systems of access among farmers and communities.

Fair and equitable benefit-sharing may be provided for in access agreements in several ways. The sharing of monetary benefits foresees payment of a specific percentage of the net benefits, for example 50%, which should go to the communities that maintain and supply genetic resources. There is also emphasis on non-monetary benefits, such as through participation in research, and through development assistance geared towards creating added value with the genetic resources in question at the local level. The Model Law foresees the establishment of a Community Gene Fund, which should channel the benefits to the communities. The Model Law also recognizes the contribution of women in the conservation of biological diversity, with a strong focus on gender equality in all aspects, including participation in policy-making, in prior informed consent and in benefit-sharing.

The Model Law also proposes a plant breeder's rights system in line with the above provisions. This recognizes the rights of breeders that develop varieties (including farmer-breeders), but provides that the exclusive rights of commercial breeders do not impinge on the customary practices of seed-saving, and permit the exchange and sale of seed of any variety, including protected varieties. It clearly states that the granting of utility patents on life forms, including parts of organisms (e.g. cells and genes) and biological process cannot be made consistent with the Model Law, and that these protection systems should not be recognized in Africa. The provisions of TRIPS Article 27.3b are relevant here.

The African Model Law does not make specific distinction in its provisions and operations for genetic resources for food and agriculture. It strongly focuses on the regulation of access and the wide participation of stakeholders. It was developed before the adoption and entry into force of the International Treaty on Plant Genetic Resources for Food and Agriculture, and is thus strongly rooted in the CBD and thus its focus on natural biodiversity.

There has been much discussion of the Model Law but few African countries have yet developed a national law that combines genetic resources and IPR issues in one regulatory framework. Namibia has gone some way in developing such a system, and draft legislation in Uganda not only includes a number of issues from the Model Law, but goes further to require the explicit prior informed consent of communities and farmers, as well as benefit-sharing agreements for the use of genetic resources within the country. The institutional framework to administer these rules is currently being developed.

The Nordic countries

The Nordic countries have, since the 1950s, developed regional co-operation through two organizations: the Nordic Council (with members from the national parliaments) and the Nordic Council of Ministers. One area of co-operation is food and agriculture. Within this co-operative framework, the Nordic Gene Bank (NGB) was established in 1979, with the mandate to conserve and document the genetic variation in Nordic material of plant species useful for agriculture and horticulture.

In the light of recent international developments regarding legal regimes for plant genetic resources, the Nordic Genetic Resources Council initiated a project with the aim of analysing these developments, and of assessing the legal status of Nordic genetic resources. The recommendations in the project report, 'A Nordic Approach to Access and Rights to Genetic Resources' (Evjen, 2003, p. 16) formed the basis for the discussions within the Nordic Council of Ministers, which in the summer of 2003 resulted in the Nordic Ministerial

Declaration on Access to and Rights over Genetic Resources (no. ANP 2004:745).

In order to reflect with the common Nordic understanding of the importance of genetic resources for development, and therefore the view that it is necessary to facilitate access to plant genetic resources in genebanks, the Declaration puts all accessions of the NGB in the public domain, and under common Nordic management and control. It further states that the NGB's relevant material shall be included in the International Treaty's Multilateral System upon the Treaty's ratification by all Nordic countries. It is recommended that individual Nordic governments confirm and implement the Declaration through appropriate decisions.

As a consequence of the Declaration, the NGB has officially stated that access to all its accessions (and not only those to be covered by the Treaty's Multilateral System) will be facilitated for all purposes (not only for use in food and agriculture). It has adopted a provisional MTA, based on that used by International Agricultural Research Centres as a consequence of their having, in 1994, put their *ex situ* collections into the International Network of *Ex Situ* Collections under the Auspices of the FAO (http://www.fao.org/ag/cgrfa/exsitu.htm). (By these agreements, they hold their materials 'in trust for the international community', under the policy guidance of the FAO Commission on Genetic Resources for Food and Agriculture.) The MTA specifies, among other things, that, in accordance with Article 12.3 d of the International Treaty, the recipient shall not claim any intellectual property or other rights that limit the facilitated access to the plant genetic resources for food and agriculture, or their genetic parts or components, in the form received. Moreover, a decision has been taken that the NGB will not claim, as a condition for access to its materials, any monetary benefits upon commercialization of a product derived therefrom.

The Nordic Ministerial Declaration furthermore recommends that the Nordic countries determine the legal status of their plant genetic resources and their wild relatives, including *in situ*, so as to be able to provide free access to all their domestic plant genetic resources.

The Swedish government complied with these recommendations by resolving that all plant genetic resources of Swedish origin managed by the NGB shall be held under common Nordic management and in the public domain. It also decided that these materials shall be included in the International Treaty's Multilateral System of Facilitated Access and Benefit-sharing.

Both the Swedish and Norwegian policy is therefore that plant genetic resources, as well as other genetic resources, shall be accessible with a minimum of restrictions and bureaucracy, and that all cultivated species should in due course be included in the Multilateral System of the International Treaty. No need for legislation is foreseen, on account of the countries having ratified the Treaty.

Options for facilitated access for agriculture research for development

Given the importance of plant genetic resources for global and household food security and for sustainable agricultural development, and taking into account the interdependence of all countries, access to genetic resources should be as easy as possible, while respecting the legitimate interests of the providers.

In practice, the CBD has not so far contributed much to the effective and efficient sharing of genetic resources for food and agriculture. In fact, agriculture has suffered problems that have arisen with regulating access to genetic resources in general (Pethiyagoda, 2004). At the national level, access in the past decade has been restricted largely because of a lack of clarity as to which institutions in provider countries have the authority to negotiate and grant access, and because, during the development of national legislation, nobody wanted to take such responsibility. The Bonn Guidelines were a step to remove important blockages. The Conference of the Parties to the CBD has recognized that they are to be implemented 'without prejudice' to the International Treaty's Multilateral System. Access to genetic resources in general has not been effective because of a lack of experience in negotiating bilateral access agreements. Most bilateral access contracts relate to the industrial use of genetic resources. Salazar *et al.* (2006) have identified only one such contract that explicitly makes a link to the provider-community. It must also be noted that the negotiation and legal defence of unique bilateral contracts for every exchange of materials implies a very significant transaction cost (Visser *et al.*, 2003), which is likely to create a market failure, and hence impede access.

International Treaty

The FAO International Undertaking on Plant Genetic Resources for Food and Agriculture was the first international agreement regulating (although on a voluntary basis) the conservation and sustainable use of any sector of genetic resources, and access and benefit-sharing. In adopting the CBD, countries agreed that the question of *ex situ* collections formed before the CBD's entry into force (which the CBD does not cover) should be addressed through the FAO. In 1993, therefore, the FAO initiated negotiations for the development of the International Treaty as a binding international instrument in harmony with the CBD. The Conference of the Parties to the CBD supported these negotiations, and (by Decision II/15) recognized the 'special nature of agricultural biodiversity, its distinctive features and problems needing distinctive solutions'. The Multilateral System of the International Treaty, which was adopted in November 2001, and entered into force on 29 June 2004, is just such a distinctive solution, which takes into account both interdependence and the crucial importance of plant genetic resources for food and agriculture for food security. The International Treaty is in harmony with the CBD.

Its objectives are the conservation and sustainable utilization of plant genetic resources for food and agriculture. Its scope is all such resources. Its Multilateral System facilitates access to key crops, which provide about 80% of humanity's food of plant origin. Notable crops not currently covered are groundnut, soybean and tomato. The implementation of the Multilateral System will be through a Standard MTA. Both access and benefit-sharing will be on a multilateral basis. The MTA will be adopted at the first meeting of the Treaty's Governing Body, which means that it is yet early to analyse the impact of this Treaty on access. The first meeting will consist of those countries that have ratified the Treaty at least 90 days beforehand, and will be in Spain in spring 2006. As of 12 July 2005, 71 countries and the European Community had ratified the Treaty.

Even though the impact cannot yet be measured, the fact that the International Treaty introduces a multilateral system forecloses need to enter into bilateral agreements between provider country and user for the resources in question (and obviates complicated individual negotiations). This is very likely to be a crucial step in making genetic resources more readily available for research.

Options under the CBD

However, various important agricultural genetic resources will not be governed by the International Treaty for some time to come. In addition to the three crops already mentioned, this is the case of all estate crops, most fruits and vegetables, and a wide range of so-called 'orphan' and underutilized crops, such as Andean tubers, and most small grains and legumes. Such crops can be very important for poverty alleviation and nutrition security, especially in areas where a more diverse diet is necessary for a healthy life. It is essential that access regulations do not stand in the way, and do not result in a decline of the research and development effort, thereby reducing the benefit for the local communities that rely on them.

In IPR practice, the so-called 'humanitarian licences' can be used to provide access to technology for non-commercial use, with a development focus. Such approaches are currently being considered in the field of access to biotechnologies and derived products in agriculture. A very innovative approach is the Generation Challenge Programme, where a clause has been proposed in the consortium agreement that automatically provides for a humanitarian licence, when technologies that have been developed by the Generation Challenge Programme are to be used for or by the poor. This means that farmers below a certain income level would not have to ask for a licence in order to reproduce and even sell seed of a protected variety or a variety containing a protected invention. This approach, in a consortium of five advanced research institutes in the North and four in the South, as well as all the International Agricultural Research Centres of the Consultative Group on International Agricultural Research that undertake plant breeding research, is an excellent example of how to open up potentially restricting policies and laws through a set of target-oriented rules agreed upon by important actors. It provides a good example for others to follow, including private-sector parties.

It would be interesting to see whether a similar approach could be possible with access to genetic resources, that is, to make materials available for agricultural research for the poor and food insecure, without the restrictions involved in bilateral MTAs, and without requiring complicated negotiations. This would create a crucial freedom to operate in participatory plant breeding and other research and development programmes directed at helping the poor and would reduce inequalities caused by differences in negotiation capacity. Without returning to the original concept of the 'heritage of mankind', this could overcome the growing unnecessary restrictions to the full use of genetic resources and reduce transaction costs. This would allow plant breeding and the new genomic technologies to contribute more effectively to alleviating poverty and reducing food and nutrition insecurity, as required by the Millennium Development Goals.

Conclusions

Plant breeding and genomic technologies that support crop improvement are of crucial importance, if agricultural development is to contribute fully to global and household food security and poverty alleviation. Initiatives to deploy these technologies in the interests of the poor, such as the Generation Challenge Programme, must be able to draw at the lowest transaction costs on the widest possible range of genetic resources and technologies.

International agreements, such as the CBD and the WTO TRIPS Agreement regulate access to materials and technologies. With regard to access to genetic resources, regions and countries are developing different strategies to design and implement their access systems based on the CBD. In most cases, they make no specific allowance for the specific nature and needs of agricultural genetic resources. Two examples were examined: the African region, through the African Union Model Law, puts emphasis on conservation, and on prior informed consent and benefit-sharing, while the Nordic countries in Europe give priority to promoting sustainable use and facilitating access.

The International Treaty on Plant Genetic Resources for Food and Agriculture addresses what the Conference of the Parties to the CBD has recognized as the 'special nature of agricultural biodiversity, its distinctive features and problems needing distinctive solutions'. It established a Multilateral System of Access and Benefit-sharing for a set of crops providing about 80% of our food from plants. Its impact on access to genetic resources for research for the poor cannot be assessed yet. Many crops that are important for smallholder farmers are not yet included in the Multilateral System. It is therefore necessary to develop ways to ensure that access and benefit-sharing laws, attendant high transaction costs and lacking negotiation capacities do not unduly hinder access to the genetic resources needed to address poverty alleviation and nutrition security.

A broad 'humanitarian licence', which the Generation Challenge Programme is currently operating for access to protected technologies, may be an interesting option if it could be applied by countries to facilitate the use of their genetic resources for and by the poor.

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