

## AGRICULTURE AND GENETIC RESOURCES



### INTRODUCTION

#### Background

The importance of the agricultural sector in developing countries as a source of food, incomes, employment and often foreign exchange cannot be overstated. As much as good health, a productive and sustainable agricultural sector is critical to achieving economic growth and poverty reduction. About three quarters of the world's poor people live and work in rural areas.<sup>1</sup> Apart from its direct role in sustaining incomes and employment, the role of agriculture, and in particular technological change in agriculture, in stimulating overall economic growth has been much discussed by economists and policymakers. Raising productivity in agriculture can directly increase the incomes and employment levels of the majority of poor people dependent on agriculture. It can also help to reduce food prices (relatively or absolutely) for poor people in both rural and urban sectors.

Historically agriculture has been seen, sometimes controversially, as a source of food, labour and finance to supply a growing urban and industrial sector on which sustained growth in incomes will depend. Achieving this transition usually depends on achieving productivity increases if food prices are not to rise, and stifle both industrial growth and poverty reduction. In developed countries changes in technology and institutions in the agricultural sector are regarded as having been instrumental in the industrial revolution.

In developing countries, technical progress traditionally occurred through a process of on-farm experimentation, selection and adaptation of traditional landraces<sup>2</sup> of crops. Subsequently this was supplemented by purposive breeding of new varieties of crops, mainly through crossing varieties with desirable characteristics. This process of research was largely conducted in the public sector by national research institutes, supported by a network of international research institutes, for the last

thirty years under the umbrella of the Consultative Group on International Agricultural Research (CGIAR). It was this network which led to the Green Revolution of the 1960s, based initially on high yielding semi-dwarf varieties of rice and wheat. In spite of criticisms of its environmental and distributional impact, this technology is widely credited with having had a favourable impact on nutrition, employment and incomes, albeit mainly in the areas of developing countries capable of reasonably assured irrigation. Subsequently, further breeding efforts have tried, but with less success, to extend these technologies to new crops and to rainfed and dryland areas.

More recently, significant changes have occurred in both the technology and the structure of research in agriculture. First, the advent of biotechnology, and in particular genetic engineering, in the last twenty years has vastly expanded the possibilities of what can be achieved in agricultural research (for example, introducing new genetic traits in plants). Secondly, while public investment in public research, at least through the CGIAR, has tended to stagnate in recent years, investment by the private sector has gone up rapidly.<sup>3</sup> Market forces have increasingly guided the direction and purpose of additional research spending.

## Intellectual Property Rights in Agriculture

Historically, systems for the protection of intellectual property were applied principally to mechanical inventions of one kind or another, or to artistic creations. The assignment of IPRs to living things is of relatively recent origin in developed countries. Vegetatively propagated plants were first made patentable in the US only in 1930. And the protection of plant varieties (or plant breeder's rights - PBRs), a new form of intellectual property, only became widespread in the second half of the 20th Century. Thus systems for the protection of plants derive from the economic structure and circumstances of agriculture that prevailed in developed countries in this period. That such systems came into being reflected the growing interest of private breeders in protecting their intellectual property. Farmers have traditionally replanted, exchanged or sold seed from the previous years' crop which means that breeders have difficulty in recouping the investments made in improved varieties through repeat sales. Patents or PBRs normally impose restrictions on farmers' ability to sell grown seed (and in some cases to reuse it) and thus enhance the market for the breeder's seed. Even in the developed countries, reuse of seeds remains quite common although for many crops annual purchase is now the rule. In developing countries the majority of farmers reuse, exchange or sell informally to neighbours, and annual purchase of new seed is relatively rare in most countries.

With the adoption of the TRIPS Agreement, developing countries have been obliged to adopt protection of plant varieties, by patents or by other means, without any serious consideration being given to whether such protection would be beneficial, both to producers and consumers, or its possible impact on food security. As with medicines, a crucial issue is whether and how intellectual property protection can help promote research and innovation relevant to the needs of developing countries and poor people. And we also need to ask how IP protection affects the cost and access of farmers to the seeds and other inputs they need.

If the aim of plant variety protection is to provide incentives to breeders, one of the questions that arises is how the contribution of farmers to the conservation and development of plant genetic resources should be recognised and preserved. Until formal breeding programmes were introduced, varietal and cultural improvements depended on a process of selection and experimentation by farmers. Formal breeding programmes have since utilised those varieties and knowledge in order to develop improved varieties of higher productivity, or with other desirable characteristics. The question is whether this contribution of farmers to conservation and innovation should be either protected or rewarded. Building on the principles embodied in the Convention on Biological Diversity (CBD), which we discuss in the next chapter, the new International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) seeks to establish principles for facilitating access to plant genetic resources and establishing fair and equitable mechanisms of benefit sharing.

In this chapter, we address the following questions:

- Can intellectual property protection on plants and genetic resources help to generate the technologies required by farmers in developing countries?
- Will IP protection affect the access of farmers to technologies they need?
- How could the intellectual property system contribute to the principles of access and benefit sharing enshrined in the CBD and the ITPGRFA?

## PLANTS AND INTELLECTUAL PROPERTY PROTECTION

### Introduction

Under TRIPS, countries may exclude from patentability plants and animals and essentially biological processes for producing them, but not microorganisms. And they are required to apply some form of protection, either by patents or a *sui generis* system to plant varieties.

There are many legal complexities about definitions arising from the wording of TRIPS, such as the exact meaning of a plant variety, a “microorganism” or an essentially biological process. But it is important to note here that TRIPS does not mention whether or not genes should be patentable, whether derived from plants, humans or animals. The issue raised by TRIPS is what constitutes an invention in relation to genetic material. For instance, should genetic material identified in nature be patentable on the grounds that isolating and purifying it differentiates it from an unpatentable discovery? This is a matter for national legislation. The only specific requirement, other than for microorganisms, is that plant varieties be protected.

Some people object altogether to the patenting of life forms on ethical grounds, considering that the private ownership of substances created by nature is wrong, and inimical to cultural values in different parts of the world. The sequencing of the human genome also raises specific concerns. We recognise these concerns, which we discuss further in Chapter 6 in the context of designing patent systems. The ethical and legal issues in respect of patenting DNA are discussed in a recent report of the Nuffield Council on Bioethics.<sup>4</sup> Our task here is to consider the practical and economic consequences of patenting in agriculture and how this affects the livelihoods of poor people and the implications for policy.

Intellectual property protection can be conferred in relation to plant materials in a number of ways:

- The US model of plant patents, which are distinct from normal (utility) patents
- Through allowing normal patents on plants or parts thereof, such as cells
- Through patenting plant varieties as is the practice in the US and in few other countries (for example, not in the EU)
- Through applying a *sui generis* form of plant variety protection (PVP), such as plant breeders’ rights (as in the EU or the US) or other modalities
- Through allowing patents on DNA sequences, and gene constructs including the gene, plants transformed with those constructs, the seed and progeny of those plants.

In addition, patents are widely used to protect the technologies which are employed in research on plant genomics.<sup>5</sup>

Apart from the use of patents and PVP, the intellectual property in plants can be appropriated by technological means. For instance, crops such as commercial hybrid<sup>6</sup> maize cannot be reused if hybrid yield and vigour are to be maintained. This characteristic of some hybrids confers a natural form of protection by which seed companies can more readily capture a return on their investment through repeat seed sales. By contrast, other types of seed variety can be replanted each year without deterioration in yield, so that farmers may replant their own seed without repurchasing.

The Green Revolution varieties were of this nature, which is one reason why they were so successful. It is only more recently that hybrid varieties of rice and then wheat have been developed. Genetic Use Restriction Technologies (known as GURTs) is a term used to describe different forms of controlling the action of genes in plants. The so-called “terminator” technology, which would render the seed sterile so that it is not physically possible to grow a second crop,<sup>7</sup> is well known but other characteristics can also be controlled, either for agronomic or commercial reasons. The effect of technological protection is similar to that of IP protection, but possibly cheaper and certainly more effective in the sense that it is self-enforcing.

## Research and Development

As compared to medical research, there is a great deal more agricultural R&D undertaken by, and of relevance to, developing countries. For instance it is estimated that in 1995, total expenditure by the public sector on agricultural research in developing countries, although unevenly distributed, amounted to \$11.5 billion (at 1993 international dollar values) compared to the \$10.2 billion spent in developed countries.<sup>8</sup> The great majority of research is conducted in the more technologically advanced developing countries in Asia and Latin America. Moreover, research expenditures by these countries grew at 5-7% annually between 1976 and 1996, while they stagnated in Africa.<sup>9</sup> By contrast, of worldwide private research expenditure totalling \$11.5 billion, only \$0.7 billion is attributable to developing countries.

This means that, globally, about one third of all agricultural R&D is spent in developing countries in marked contrast to the maximum of 5% estimated for health research for developing countries. Three points should be noted here. First, global R&D<sup>10</sup> on agriculture is only a little more than half that estimated for health R&D. Secondly, there is almost twice as much agricultural R&D in the public sector as the private sector. In medicine, expenditure by the private sector is proportionately larger, as we have seen. Thirdly, and partly as a result, the developing countries are relatively better served in the case of agricultural research.

Nevertheless current trends give cause for concern. Although the CGIAR spends only about \$340 million per year, its role is strategically important. For instance, the CGIAR centres played a crucial role in the Green Revolution and now act as the guardian of the world’s largest collection of genetic resources of relevance to developing countries, which is the major source of crop improvements for the future. But funding for the CGIAR system, which is provided by the donor community, has fallen in real terms since 1990<sup>11</sup> and this threatens both its research effort and its ability to maintain its gene banks, or assist developing countries in maintaining their own collections. Indeed the FAO and CGIAR have launched an endowment specifically to ensure that these genetic materials across the world can be properly maintained.<sup>12</sup> While funding from the aid donor community is stagnating, the private sector is the dynamic element in agricultural R&D, but little of its effort is of direct relevance to poor farmers in developing countries.

## The Impact of Plant Variety Protection

In this section we examine the evidence on the impact of plant variety protection (PVP) in developed and developing countries and what PVP systems might have to offer developing countries.

Most of the evidence relating to the impact of patent or plant variety protection on research is from developed countries, and even that is quite sparse. Before IP protection was introduced, private sector breeding initiatives focused on hybrid varieties, particularly of maize in the US, because inherent in these varieties is an element of “technological protection”. In the US a study from the 1980s suggested there was no evidence that total R&D activity had increased as a result of the introduction of PVP, although it appeared to have had some impact on soya beans, and perhaps wheat.<sup>13</sup> The latter crops also accounted for the majority of PVP certificates issued. There was also evidence that PVP was used as a marketing strategy for product differentiation and that it had contributed to the large number of mergers that took place in the seed industry. But the evidence

is inconclusive, in particular because of the difficulty in isolating the effect of protection from other ongoing changes. Even now research spending on hybrid crops as a share of sales continues to exceed that on non-hybrid crops, which are the principal object of PVP.<sup>14</sup> A recent study found that PVP on wheat in the US had not contributed to increased investment in private sector wheat breeding, but may have done so in the public sector. Nor had it contributed to an increase in yields. But the share of wheat acreage sown to private varieties had increased markedly, reinforcing the suggestion that the main impact of PVP was as a marketing tool.<sup>15</sup>

A major study conducted in middle income developing countries<sup>16</sup> found little evidence of an increased range of plant material available to farmers or increased innovation as a result of PVP protection. Access to foreign genetic material had improved, but its use was sometimes subject to restrictions, for example on exports. Generally speaking, commercial farmers and the seed industry were perceived as the principal beneficiaries. Poor farmers had not benefited directly from protection, but could potentially be adversely affected by restrictions on seed saving and exchange in the future.

Under TRIPS, developing countries may choose an “effective *sui generis*” PVP system. A major decision is to identify a system that is suitable to their particular agricultural and socio-economic circumstances. The UPOV Convention (see Box 3.1) is one system which they may adopt, based on the legislation introduced in Europe and the US. A consideration is that it provides a ready made legislative framework, but a disadvantage is that it was designed with the commercialised farming systems of the developed countries in mind. There are therefore concerns expressed about the application of the UPOV model in developing countries, some of which apply to any form of PVP.

The criteria for awarding a PVP certificate involve lower thresholds than the standards required for patents. There are requirements for novelty and distinctness, but there is no equivalent of non-obviousness (inventive step) or utility (industrial applicability). Thus, PVP law allows breeders to protect varieties with very similar characteristics, which means the system tends to be driven by commercial considerations of product differentiation and planned obsolescence, rather than genuine improvements in agronomic traits.<sup>17</sup> Developing countries might consider raising the threshold, in particular so that protection is only given for significant or important innovations with particular characteristics that are deemed socially beneficial (for example, yield increases, or traits of nutritional value). Thus the criteria for distinctness may be strengthened, and also criteria formulated defining utility in terms of the objectives of agricultural policy. Alternatively, countries may decide to retain lower standards for certain categories of plant in order to facilitate access by nascent domestic breeding industries to PVP protection from which may flow commercial and export benefits.

Similarly, the requirement for uniformity (and stability) in UPOV type systems excludes local varieties developed by farmers that are more heterogeneous genetically, and less stable. But these characteristics are those that make them more adaptable and suited to the agro-ecological environments in which the majority of poor farmers live. Again it would be open to developing countries to devise systems that would offer protection for varieties that meet criteria suited to the circumstances and crops on which poor farmers depend. But such criteria may be difficult to devise, and the system costly to operate. And governments may consider that extending such a system would not play a positive role in the development of their farming systems.

Another concern is about the criterion for uniformity. While proponents argue that PVP, by stimulating the production of new varieties, actually increases biodiversity, others claim that the requirement for uniformity, and the certification of essentially similar varieties of crops, will add to uniformity of crops and loss of biodiversity. Of course this concern goes wider than PVP. Seed legislation in many countries imposes strict uniformity requirements, sometimes stricter than PVP legislation. Moreover similar concerns have arisen in respect of greater uniformity arising from the success of Green Revolution varieties, leading to greater susceptibility to disease and loss of on-field biodiversity. But, as plant breeding becomes an increasingly private sector activity, and new varieties displace traditional varieties on a large scale, there is the crucial issue of how genetic resources are to be conserved and maintained for possible future use, whether in fields or in “gene banks.”<sup>18</sup>

There may also be a need to differentiate standards of protection between different kinds of crop. For instance, countries with significant commercial and export sectors might adopt UPOV-type standards for the relevant crops in those sectors to encourage innovation and commercialisation. But they might adopt other standards for food crops grown by farmers to protect their practices of saving, trading and exchanging seeds, and informal systems of innovation. For instance, in Kenya PVP rights seem to have been predominantly applied for by the foreign-owned commercial exporters of flowers and vegetables to underpin commercialisation and exporting. This may be beneficial to the expansion of Kenya's export industries and commercial agriculture, and indirectly to poor people. PVP may facilitate the availability of new varieties in Kenya (which might have been withheld in the absence of protection) but appears to play little part in stimulating local research. The system has not appeared to be very relevant to the direct concerns of Kenya's poor farmers and the crops they grow.

### **Box 3.1. Union Internationale pour la Protection des Obtentions Végétales/ International Union for the Protection of New Varieties of Plants (UPOV)**

The internationally recognised agreement on PVP protection is UPOV. The UPOV Convention dates from 1961, and has been revised thrice subsequently. Apart from South Africa, the first developing countries to join UPOV were Uruguay and Argentina in 1994, when there were 26 members in total. Since 1994, 24 further developing countries have joined UPOV. Although TRIPS only specifies that there should be a *sui generis* regime, UPOV has been an obvious choice as it provides an off-the shelf solution to developing such legislation. In addition, pressure has been put on various countries to join UPOV in the context of bilateral trade agreements (for instance, the recently concluded Vietnam-US trade agreement obliges both parties to be members of UPOV, of which the US is already a member).

The purpose of the UPOV Convention is to ensure that the member States of the Union acknowledge the achievements of breeders of new plant varieties, by making available to them exclusive property right, on the basis of a set of uniform and clearly defined principles.

As UPOV has been revised successively (1978 and 1991), the scope and length of protection has been extended. The minimum period of protection increased to 20 years (25 years for vines and trees) in the 1991 version (from 15 and 20 previously). Unlike patents, the criteria for protection do not involve an inventive step as such. Rather, to be eligible, varieties must only be distinctive, uniform and stable (DUS in the jargon) and novel (in terms of prior commercialisation).

The 1978 Act allowed breeders to use protected varieties as a source for new varieties, which could then be protected and marketed themselves. The 1991 Act has preserved the breeders' exception, but the right of the breeder extends to varieties which are "essentially derived" from the protected variety, which cannot be marketed without the permission of the holder of the original variety.

The 1978 Act provided the breeder with protection in respect of production for the sale of seed, its offer for sale and its commercialisation (Article 5 (1)) and it therefore implicitly allowed farmers to replant and exchange the seed (although this right is not spelt out). The 1991 Act is more restrictive of the rights of farmers. The right of the breeder now extends to production or reproduction, in addition to the marketing of propagated or harvested material (Article 14 (1)). This is mitigated by an optional farmers' exception which allows "farmers to use for propagating purposes, on their own holdings, the product of the harvest which they have obtained by planting, on their own holdings, the protected variety or [an essentially derived variety]." (Article 15 (2)).<sup>19</sup>

Thus developing countries should consider basing their PVP legislation on a realistic appreciation of how it could benefit their agricultural development and food security, taking account also of agriculture's role in generating exports, foreign exchange and employment. In particular they need to consider possible modifications to the UPOV model to adapt it to their circumstances.<sup>20</sup> A number of countries have passed or are considering legislation which incorporates elements described above.<sup>21</sup>

An important aspect of *sui generis* systems is the scope of the farmers' exception. Unlike patents, PVP legislation generally allows an exception, as in UPOV 1978, which permits farmers to reuse on their own holding harvested seeds without the permission of the rightsholder. In the US, this exception was expanded to allow limited sale of harvested crops for seed purposes to other farmers. And, in the developing world, in the absence of legal rules, farmers exchange and sell their seeds informally. As we have noted, this is a practice which is still very widespread amongst poor farmers in developing countries, and even still common in developed countries. These systems of sale and exchange are an important mechanism by which farmers have traditionally selected and improved their own varieties, and the restriction of this right may impede this process of improvement. Although UPOV (1991) permits nations to allow farmers to reuse their own crop for seed purposes on their own holdings, it does not allow for informal sale or exchange. In contrast, TRIPS only requires that there should be some form of IP protection for plant varieties, and does not define in any way the exceptions that may be provided to the rights of owners of protected varieties.

Thus countries and organisations have experimented with a number of alternatives in this area. For instance, the OAU (now the African Union) has produced model legislation which it recommends African countries adapt in their own legislation. This provides for the right to save, use, multiply and process farm-saved seed, but not to sell it on a commercial scale.<sup>22</sup> The Indian government, which has recently decided to seek admission to UPOV, has incorporated in its PVP legislation (2002) a clause (39 (1) (iv)) that states:

"a farmer shall be deemed to be entitled to save, use, sow, re-sow, exchange, share or sell his farm produce including seed of a variety protected under this Act in the same manner as he was entitled to before the coming into force of this Act:

Provided that the farmer shall not be entitled to sell branded seed of a variety protected under this Act."<sup>23</sup>

The breeders' exception under PVP also differs from patent law in that breeders may, without authorisation, use a protected variety as the basis for breeding another variety (which itself may then gain protection). Thus PVP provides less protection than patents, and as we have argued little incentive for research, but correspondingly is less restrictive of incremental follow-on innovation than patents. Again developing countries are free to choose exactly what exceptions they provide. At one extreme, PVP could be conferred as a superior kind of seed certificate or seal giving the holder the sole rights to sell seed with this seal. But there would be no rights to protect subsequent use or sale of the seed, as long as it was not sold under the certificate. This right would be superior to a trademark or seed certificate, but would not restrict subsequent reuse of harvested material in any way. Such a system might be a way to tailor the PVP system to the needs of poor farmers, but it would offer less incentive for breeders.<sup>24</sup>

## The Impact of Patents

Patents on plant varieties, as such, are only allowed in the US, Japan and Australia, and are most frequent in the US. The 1930 US Act introduced a special kind of Plant Patent for vegetatively propagated materials, but in the US standard utility patents can also now be granted on plant varieties. Patents are the strongest form of intellectual property protection in the sense that they normally allow the rightsholder to exert the greatest control over the use of patented material by limiting the rights of farmers to sell, or reuse seed they have grown, or other breeders to use the

seed (or patented intermediate technologies) for further research and breeding purposes. However, patent law can provide for exceptions similar to those in PVP systems. For example, the EU Biotechnology Directive, while not permitting the patenting of plant varieties, provides for a farmer's exception where a patent on genetic material would otherwise prevent reuse on the farm. It also contains a provision for compulsory licensing, subject to certain conditions, where a breeder's use of material would otherwise infringe the patent right.<sup>25</sup>

In the US, the patenting of plant varieties is particularly important because, with appropriate claims in the patent, the holder of the patented variety can prevent others from using it for breeding purposes. This is a significant difference from PVP. Proving that a new variety meets the criteria for patentability is more difficult and more costly than obtaining plant variety protection, where the criteria for protection are lower. Patent protection is also frequently obtained through a broad patent which claims the gene, the vector or carrier for effecting the transformation and so on, which may cover a number of potential varieties or crops incorporating the gene. For practical purposes this may have the same effect as patenting the whole plant, because the patent normally extends to "all material...in which the product is incorporated".<sup>26</sup>

Whatever the incentives provided by patenting, market forces will tend to direct research efforts by the private sector to where there is the most substantial potential return. However, in contrast to medicines, there is the potential for companies to become attracted to crops that are widely grown in developing countries. The investment costs are correspondingly lower than for medical research, and the potential markets correspondingly larger. For instance rice, where the value of production in India alone exceeds that of the US maize market, has hitherto been a crop where breeding has been the preserve of the national or international public sector (principally the CGIAR). Since then the private sector has become increasingly interested in rice research. Monsanto and Syngenta have worked on sequencing the rice genome of two major rice varieties. The number of patents relating to rice issued annually in the US has risen from less than 100 in 1995 to over 600 in 2000.<sup>27</sup>

So far about 80% of trials of transgenic crops have occurred in developed countries, where three quarters of the world's GM crops are grown. The breeding strategies of the multinationals have been naturally oriented to the needs of developed world markets, and the commercial sectors of middle income developing countries (for example, Brazil, Argentina or China). The development of genetic traits such as herbicide tolerance has been determined principally by the search for commercial advantage, rather than for characteristics useful to poor farmers in developing countries. But companies are introducing GM varieties which, although controversial both in developed and developing countries, are considered by some developing countries to be of potential benefit to them (for example, the Bt gene which confers insect resistance).<sup>28</sup> Bt Cotton or Bt maize is now grown in at least five developing countries, and other countries may be interested, if they can resolve environmental concerns. For instance, India has recently approved the planting of Bt Cotton. Companies have also donated technologies of relevance to developing countries (for example, through royalty free licences), including those related to vitamin A enriched rice (Golden Rice) and cassava. Some companies have published scientific articles based on their genomic research, but have aroused controversy by not depositing the raw data in public databanks. Negotiations about the deposit in public databanks have been complicated by the companies' desire to limit access to components of data with the greatest potential commercial value.<sup>29</sup>

Thus there is the potential for agricultural technologies developed by the private sector to spill over to the benefit of the commercial sectors in developing countries. But if the Green Revolution which was developed and applied with public sector funding failed to reach effectively poor farmers living in agro-ecologically diverse rainfed environments, it is apparent that biotechnology-related research led by the private sector will be even less likely to do so. For that, more public sector research specifically oriented to such farmers will be required. In 1998, the CGIAR system spent \$25 million on such research compared to the \$1.26 billion invested by Monsanto.<sup>30</sup>



Apart from the problem of incentives for research relevant to poor farmers, there is evidence that patents, and to some extent PVP, have played a part in the major consolidation of the global seed and agricultural input industries. The consolidation appears to be driven by technological change, with an objective of vertical and horizontal integration so that the appropriability of investment in research can be maximized through better control of distribution channels, including those of complementary agricultural inputs (such as herbicides).

Companies acquire patent rights to protect their own investment in research, and to prevent the encroachment of others. But by the same token, other companies' patent rights can impede one's own research. For instance, there are several hundred overlapping patent rights for the Bt technology, and at least four companies obtained patents that cover Bt-transformed maize.<sup>31</sup> Recently, Syngenta filed two law suits in the US against a number of its competitors alleging infringement of several of its patents relating to this technology, although the companies involved have been using these technologies, and selling seeds incorporating them, for several years.<sup>32</sup> Cross licensing,<sup>33</sup> or strategic alliances, can also be used as mechanisms to overcome problems of conflicting patents,<sup>34</sup> but merger or acquisition may be the most effective means of obtaining the freedom to use required technologies in a particular field of research. All of these approaches, not just the last, reduce competition. And the major multinational agrochemical companies, with their growing control over essential proprietary technologies, also represent a formidable barrier to the entry of innovative start-ups.<sup>35</sup> In the 1980s, the university and public sector accounted for 50% of the total of granted US patents relating to Bt. By 1994, independent biotechnology companies and individuals held 77%, but by 1999 the big six companies (which became five with the merger of the agricultural arms of AstraZeneca and Novartis to form Syngenta) held 67%. Moreover, the growing control of these companies was demonstrated by the fact that 75% of their Bt patents in 1999 had been obtained by the acquisition of smaller biotechnology and seed companies.<sup>36</sup>

In developing countries, there is evidence of similar trends with an extremely rapid process of merger and acquisition by the multinational companies. For instance, in Brazil, following the introduction of plant variety protection in 1997 (but presumably also related to the expected permission to grow GM crops), Monsanto increased its share of the maize seed market from 0% to 60% between 1997 and 1999. It acquired three locally based firms (including Cargill as the result of an international deal), while Dow and Agrevo (now Aventis) also increased their market share by acquisition. Only one Brazilian-owned firm remained with a 5% market share.<sup>37</sup> This trend appears widespread in developing countries.<sup>38</sup>

Thus, the speed of concentration in the sector raises serious competition issues. There are considerable dangers to food security if the technologies are overpriced to the exclusion of small farmers, or there is no alternative source of new technologies, particularly from the public sector. Further, the increase in concentration, and the conflicting patent claims when both the public and private sectors have patented plant technologies, may have had an inhibiting effect on research. In the private sector the response has been alliances or acquisitions, but a problem for the public sector is how to access the technologies they need to undertake research without infringing IP rights and, if they develop new technologies, the terms on which they may be made available. A recent review published by the US Department of Agriculture concludes that "whether the current intellectual property regime is stimulating or hampering research is unclear."<sup>39</sup> We return to this subject in Chapter 6.

## Conclusion

Thus developing countries have possibly three options for meeting their obligation to protect plant varieties under TRIPS. They may adopt one or a combination of the following:

- UPOV style legislation based on the 1978 or 1991 Convention (although they may now only join the 1991 Convention)
- Another form of *sui generis* system, including or not landraces
- Patents on plant varieties

Our reservations about the possible impact of patents apply not just to patents on plant varieties but also to plants and animals in general. At present there appears to be little evidence that providing patent protection for biotechnology-related inventions is really in the interests of the majority of developing countries which have little or no capability in this technology. We would therefore recommend that maximum use be made of the possibilities under TRIPS of excluding such inventions from patent protection. Even where TRIPS requires patent protection to be available, for example in respect of microorganisms, there is still scope for developing countries to restrict the scope of protection. In particular, in the absence of any universally recognised definition of what constitutes a “microorganism”, developing countries remain free to adopt a credible definition that limits the range of material covered.<sup>40</sup>

**Developing countries should generally not provide patent protection for plants and animals, as is allowed under Article 27.3(b) of TRIPS, because of the restrictions patents may place on use of seed by farmers and researchers. Rather they should consider different forms of *sui generis* systems for plant varieties.**

**Those developing countries with limited technological capacity should restrict the application of patenting in agricultural biotechnology consistent with TRIPS, and they should adopt a restrictive definition of the term “microorganism.”**

Countries that have, or wish to develop, biotechnology-related industries may wish to provide certain types of patent protection in this area. If they do so, specific exceptions to the exclusive rights, for plant breeding and research, should be established. The extent to which patent rights extend to the progeny or multiplied product of the patented invention should also be examined and a clear exception provided for farmers to reuse seeds.

The continuing review of Article 27.3(b) of TRIPS should also preserve the right of countries not to grant patents for plants and animals, including genes and genetically modified plants and animals, as well as to develop *sui generis* regimes for the protection of plant varieties that suit their agricultural systems. Such regimes should permit access to the protected varieties for further research and breeding, and provide at least for the right of farmers to save and plant-back seed, including the possibility of informal sale and exchange.

Because of the growing concentration in the seed industry, public sector research on agriculture, and its international component, should be strengthened and better funded. The objective should be to ensure that research is oriented to the needs of poor farmers; that public sector varieties are available to provide competition for private sector varieties; and that the world’s plant genetic resource heritage is maintained. In addition, this is an area in which nations should consider the use of competition law to respond to the high level of concentration in the private sector.

# ACCESS TO PLANT GENETIC RESOURCES AND FARMERS' RIGHTS

## Introduction

As noted above, a major issue of importance to the future of agricultural research is the conservation of genetic resources held in fields and in national and international collections, along with guaranteed access for researchers on terms that recognise the contribution made by farmers in the developing world in conserving, improving and making available these resources.

The foundation for international action to ensure the conservation, use and availability of plant genetic resources was the FAO Undertaking on Plant Genetic Resources agreed in 1983. Subsequently, the concept of Farmers' Rights<sup>41</sup> arose in debates in the FAO where it was recognised that there was an imbalance between the IP rights afforded to breeders of modern plant varieties and the rights of farmers who were responsible for supplying the plant genetic resources from which such varieties were mainly derived. A second concern was the consistency between making available plant genetic resources as the common heritage of mankind, and the taking out of private IP rights on varieties derived from them.

In 1989 the FAO agreed to recognise these concerns by incorporating Farmers' Rights "arising from the past, present and future contributions of farmers in conserving, improving, and making available plant genetic resources, particularly those in the centres of origin/ diversity" in the Undertaking.<sup>42</sup> Farmers' Rights were to be implemented through an International Fund for Plant Genetic Resources, which would finance relevant activities, particularly in developing countries. Subsequently the FAO agreed that "Plant Breeders' Rights, as provided for under UPOV...are not incompatible with the International Undertaking," a choice of words that reflected the continuing ambivalence felt by some developing countries about the underlying consistency between the Undertaking and UPOV.<sup>43</sup>

Following the agreement of the CBD in 1992, it was on this basis that the process of transforming the Undertaking into the Treaty (ITPGRFA), finally agreed in 2001, was undertaken.<sup>44</sup> The ITPGRFA has the specific objective of facilitating access to plant genetic resources held by contracting parties, and those in international collections, for the common good, recognising that these are an indispensable raw material for crop genetic improvement, and that many countries depend on genetic resources which have originated elsewhere. This represents an implementation of the CBD principles taking account of the specific characteristics of plant genetic resources. Most varieties now in existence, in particular those derived from public breeding programmes, contain genetic material from many sources, often derived from genetic material in gene banks, which themselves may have diverse origins.

The ITPGRFA also recognises the contribution of farmers in conserving, improving and making available these resources, and that this contribution is the basis of Farmers' Rights. It does not limit in any form whatsoever rights that farmers may enjoy under national law to save, use, exchange and sell farm-saved seed. It also sets out the right to participate in decision making about, and to derive fair and equitable benefits from, the use of these resources (see Box 3.2).

## Farmers' Rights

The ITPGRFA leaves it entirely up to national governments to implement Farmers' Rights (paragraph 9.2). Thus, implementing specific Farmers' Rights is not an international obligation like that imposed under provisions in TRIPS.

The rationale for Farmers' Rights combines arguments about equity and economics. Plant breeders and the world at large benefit from the conservation and development of plant genetic resources undertaken by farmers, but farmers are not recompensed for the economic value they have

contributed. Farmers' Rights may be seen as a means of providing incentives for farmers to continue to provide services of conservation and maintenance of biodiversity. As noted, the protection of plant varieties contains an inherent tendency to encourage uniformity and reduce biodiversity, to which the traditional practices of farmers are an essential counterweight. Farmers should be supported in recognition of the economic value they conserve, which is not recognised in the market system, and is to some extent threatened by technical change and the extension of plant breeders' protection. Moreover, the extension of intellectual property protection does carry the risk of restricting farmers' rights to reuse, exchange and sell seed, the very practices which form the basis of their traditional role in conservation and development.

Farmers' Rights are not an intellectual property right, but they need to be viewed as an important counterbalance to the rights accorded to breeders in the formal sector under PVP or patents. However, defining how to implement these rights at national level is complex, as we discuss in the next chapter in the context of CBD. The Treaty provides for a financing mechanism to be set up, financed by contributions and the share of the proceeds of commercialisation, which will enable the implementation of agreed plans and programmes for farmers "who conserve and sustainably utilise plant genetic resources for food and agriculture."<sup>45</sup>

### Box 3.2 Farmers' Rights In ITPGRFA (Article 9)

9.1 The Contracting Parties recognize the enormous contribution that the local and indigenous communities and farmers of all regions of the world, particularly those in the centres of origin and crop diversity, have made and will continue to make for the conservation and development of plant genetic resources which constitute the basis of food and agriculture production throughout the world.

9.2 The Contracting Parties agree that the responsibility for realizing Farmers' Rights, as they relate to plant genetic resources for food and agriculture, rests with national governments. In accordance with their needs and priorities, each Contracting Party should, as appropriate, and subject to its national legislation, take measures to protect and promote Farmers' Rights, including:

- (a) protection of traditional knowledge relevant to plant genetic resources for food and agriculture;
- (b) the right to equitably participate in sharing benefits arising from the utilization of plant genetic resources for food and agriculture; and
- (c) the right to participate in making decisions, at the national level, on matters related to the conservation and sustainable use of plant genetic resources for food and agriculture.

9.3 Nothing in this Article shall be interpreted to limit any rights that farmers have to save, use, exchange and sell farm-saved seed/propagating material, subject to national law and as appropriate.

## The Multilateral System

Under the Treaty, countries have agreed to provide facilitated access to plant genetic resources from an agreed list of crops listed in an annex, which are important for food security. By signing the Treaty, governments agree to put such resources under their direct control into the “Multilateral System”. They will also encourage institutions, not under their direct control, to do likewise. Of particular importance is the large collection of genetic material of interest to developing countries under the aegis of the CGIAR, but there are of course many national collections of worldwide importance in both developed and developing countries, as well as the store of genetic diversity in farmers’ fields.

With regard to IPRs, the potentially contentious part of the treaty is that referring to the protection of resources accessed from the Multilateral System. As finally agreed the Treaty states:

“Recipients 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 from the Multilateral System;”<sup>46</sup>

This wording is inevitably a diplomatic compromise, reflecting a desire on the part of many developing countries to avoid a limitation on access being imposed by the grant of IP rights, and of some developed countries to allow patenting of genetic material according to existing criteria applied nationally. The crucial words “in the form received” mean that material received cannot be patented *as such*, but they do allow patents to be taken out on modifications (however defined) to that material.

The compromise wording clearly excludes the patenting of seeds as obtained from a seed bank. But the extent to which patents can be taken out on a gene isolated from that material is controversial. During the negotiation of the Treaty, some countries were of the opinion that this article should be read as precluding such patenting. Others thought that the isolated form of a gene (for which a function has also been determined) is different than the “form received” and, hence, should be patentable. Thus the wording raises the important general issue of what are the appropriate rules for patenting genetic material, both for developed and developing countries. This revolves around the nature of the inventive step required for patenting, the nature of the claims for the invented use of that material, and the extent to which those claims might limit use of the underlying genetic material. We discuss this further in Chapter 6.

The Treaty has also established an important principle in that any user of material will sign a standard Material Transfer Agreement (MTA),<sup>47</sup> to be devised by the Governing Body of the Treaty, which will incorporate the conditions for access agreed in the Treaty (paragraph 12.3) and provide for benefit sharing of the proceeds of any commercialisation arising from the material through a Fund established under the Treaty. This significantly goes beyond the provisions of CBD in suggesting a concrete mechanism for benefit sharing, based on multilateral rather than bilateral arrangements.

**Developed and developing countries should accelerate the process of ratification of the FAO International Treaty on Plant Genetic Resources for Food and Agriculture and should, in particular, implement the Treaty’s provisions relating to:**

- **Not granting IPR protection of any material transferred in the framework of the multilateral system, in the form received.**
- **Implementation of Farmers’ Rights at the national level, including (a) protection of traditional knowledge relevant to plant genetic resources for food and agriculture; (b) the right to equitably participate in sharing benefits arising from the utilisation of plant genetic resources for food and agriculture; (c) the right to participate in making decisions, at the national level, on matters related to the conservation and sustainable use of plant genetic resources for food and agriculture.**

- <sup>1</sup> IFAD (2001) *"Rural Poverty Report 2001 - The Challenge of Ending Rural Poverty"*, IFAD, Rome, pp. 14-15.  
Source: <http://www.ifad.org/poverty/>
- <sup>2</sup> See Glossary for definition.
- <sup>3</sup> See next section
- <sup>4</sup> See Nuffield Council on Bioethics (2002) *"The Ethics of Patenting DNA: A Discussion Paper"*, Nuffield Council on Bioethics, London, pp.21-23.  
Source: <http://www.nuffieldbioethics.org/filelibrary/pdf/theethicsofpatentingdna.pdf>
- <sup>5</sup> See Glossary for definition.
- <sup>6</sup> See Glossary for definition.
- <sup>7</sup> This technology has not been commercially implemented yet.
- <sup>8</sup> Pardey, P. & Beintema, M. (2001) *"Slow Magic: Agricultural R&D a Century After Mendel"* International Food Policy Research Institute, Washington DC, p. 10. Source: <http://www.ifpri.cgiar.org/pubs/fps/fps36.pdf>. Note that these figures are based on purchasing power parity exchange rates which the authors consider a more accurate reflection of relative magnitudes. In ordinary \$ terms, the developed country share is considerably higher (69% rather than 44%, see p.5).
- <sup>9</sup> Pardey, P. & Beintema, M. (2001), p.4
- <sup>10</sup> For data on health-related R&D, see Commission on Macroeconomics and Health (2001) *"Macroeconomics and Health: Investing in Health for Economic Development"*, WHO, Geneva, footnote 103, p.124.  
Source: [http://www3.who.int/whosis/cmh/cmh\\_report/e/report.cfm?path=cmh,cmh\\_report&language=english](http://www3.who.int/whosis/cmh/cmh_report/e/report.cfm?path=cmh,cmh_report&language=english)
- <sup>11</sup> Pardey, P. & Beintema, M. (2001), p.8.
- <sup>12</sup> Speech by Geoffrey Hawtin at World Food Summit, 13 June 2002.  
Source: [http://www.fao.org/worldfoodsummit/top/detail.asp?event\\_id=12899](http://www.fao.org/worldfoodsummit/top/detail.asp?event_id=12899)
- <sup>13</sup> Butler L. & Marion, B. (1985) *"The Impacts of Patent Protection on the US Seed Industry and Public Plant Breeding"*, Food Systems Research Group Monograph 16, University of Wisconsin, Madison.
- <sup>14</sup> Shoemaker, R. et al (2001) *"Economic Issues in Biotechnology"*, ERS Agriculture Information Bulletin No. 762, USDA, Washington DC, p. 36.
- <sup>15</sup> Alston, J. & Venner, R. (2000) *"The Effects of the US Plant Variety Protection Act on Wheat Genetic Improvement"*, EPTD Discussion Paper No. 62, International Food Policy Research Institute, Washington DC.  
Source: <http://www.grain.org/docs/eptdp62.pdf>
- <sup>16</sup> Van Wijk, J. & Jaffe, W. (1995) *"Impact of Plant Breeders Rights in Developing Countries"* Inter-American Institute for Cooperation on Agriculture, San Jose, and University of Amsterdam.
- <sup>17</sup> Rangnekar, D. (2002) *"Access to Genetic Resources, Gene-based Inventions and Agriculture"*, Commission on Intellectual Property Rights Background Paper, 3a, Commission on Intellectual Property Rights, London, p.39. Source: <http://www.iprcommission.org>
- <sup>18</sup> Louwaars, N. & Marrewijk, G. (1996), *"Seed Supply Systems in Developing Countries"*, Technical Centre for Agricultural and Rural Cooperation, Wageningen Agricultural University, Wageningen, p. 99.
- <sup>19</sup> UPOV 1978. Source: <http://www.upov.int/eng/convntns/1978/pdf/act1978.pdf>. UPOV 1991.  
Source: <http://www.upov.int/eng/convntns/1991/pdf/act1991.PDF>
- <sup>20</sup> IPGRI has produced a useful document which discusses the issues developing countries should consider in adopting sui generis regimes. IPGRI (1999) *"Key Questions for Decisionmakers: Protection of Plant Varieties under the WTO TRIPS Agreement"*, IPGRI, Rome.  
Source: [http://www.ipgri.cgiar.org/publications/pubsurvey.asp?id\\_publication=41](http://www.ipgri.cgiar.org/publications/pubsurvey.asp?id_publication=41).  
A more detailed review we have drawn on here is Leskien, D. & Flitner, M. (1997) *"Intellectual Property Rights and Plant Genetic Resources: Options for a Sui Generis System"*, Issues in Genetic Resources No. 6, IPGRI, Rome.  
Source: [http://www.ipgri.cgiar.org/publications/pubfile.asp?ID\\_PUB=497](http://www.ipgri.cgiar.org/publications/pubfile.asp?ID_PUB=497)
- <sup>21</sup> See, for instance, the GRAIN website. Source: <http://www.grain.org/publications/nonupov-en.cfm>
- <sup>22</sup> "African Model Legislation for the Protection of the Rights of Local Communities, Farmers and Breeders and for the Regulation of Access to Biological Resources", Organisation of African Unity, 2000, Article 26.  
Source: <http://www.grain.org/publications/oau-model-law-en.cfm>
- <sup>23</sup> "Protection of Plant Varieties and Farmer's Rights Act", Government of India, 2000.  
Source: <http://www.grain.org/brl/pvp-brl-en.cfm>
- <sup>24</sup> This idea comes from Leskien and Flitner (1997).
- <sup>25</sup> Directive 98/44/EC of the European Parliament and of the Council of 6 July 1998 on the legal protection of biotechnological inventions, Official Journal L 213, 30 July 1998, pp.13-21, (Articles 11 and 12).  
Source: [http://europa.eu.int/smartapi/cgi/sga\\_doc?smartapi!celexapi!prod!CELEXnumdoc&lg=EN&numdoc=31998L0044](http://europa.eu.int/smartapi/cgi/sga_doc?smartapi!celexapi!prod!CELEXnumdoc&lg=EN&numdoc=31998L0044)

&model=guichett. These provisions were implemented in the UK in 2002.

See: <http://www.patent.gov.uk/about/ippd/notices/biotech.htm>

<sup>26</sup> See Directive 98/44EC, Article 9 (and also Article 8).

<sup>27</sup> Barton, J. & Berger, P. (2001) "Patenting Agriculture", *Issues in Science and Technology*, Summer 2001, p.4. Source: [www.nap.edu/issues/17.4/p\\_barton.htm](http://www.nap.edu/issues/17.4/p_barton.htm)

<sup>28</sup> The potential benefits and risks of GM crops for developing countries are discussed in Nuffield Council on Bioethics (1999) "*Genetically Modified Crops: The Ethical and Social Issues*" Nuffield Council on Bioethics, London, Chapter 4. Source: <http://www.nuffieldbioethics.org/filelibrary/pdf/gmcrop.pdf>

<sup>29</sup> See, for instance, Normile, D. (2002) "Syngenta Agrees to Wider Release" *Science*, vol. 296, pp.1785-1787.

Source: <http://www.sciencemag.org/cgi/content/full/296/5574/1785b?ijkey=pUrgaGgEb0z7.&keytype=ref&siteid=sci>

<sup>30</sup> Pardey, P. & Beintema, M. (2001), p.19.

<sup>31</sup> Barton, J. & Berger, P. (2001) p.4.

Source: [http://www.syngenta.com/en/media/printer.asp?article\\_id=234](http://www.syngenta.com/en/media/printer.asp?article_id=234)

<sup>33</sup> See Glossary for definition.

<sup>34</sup> See, for instance, two recent agreements announced on 2/3 April 2002, between Monsanto and DuPont, and Monsanto and Ceres. Source: <http://www.monsanto.com/monsanto/media/02/default.htm>

<sup>35</sup> The big six companies were normally regarded as AstraZeneca, Aventis, Dow, DuPont, Monsanto, and Novartis, which became five in 2000 with merger of the agricultural arms of Novartis and AstraZeneca.

<sup>36</sup> De Janvry, A., Graff, G., Sadoulet, E. & Zilberman, D. (2000) "*Technological Change in Agriculture and Poverty Reduction*" University of California, Berkeley. Concept paper for WDR on Poverty and Development 2000/2001, pp.6-7. Source: <http://www.worldbank.org/poverty/wdrpoverty/background/dejanvry.pdf>

<sup>37</sup> Wilkinson, J. & Castelli, P. (2000) "*The Internationalisation of Brazil's Seed Industry: Biotechnology, Patents and Biodiversity*", ActionAid Brazil, Rio de Janeiro, p.49. Source: <http://www.actionaid.org.br/e/pdf/seed.pdf>

<sup>38</sup> Byerlee, D. & Fischer, K. (2001) "Accessing Modern Science: Policy and Options for Agricultural Biotechnology in Developing Countries", *IP Strategy Today*, No. 1, p.2.

Source: <http://www.biodevelopments.org/ip/ipst1hr.pdf>

<sup>39</sup> Shoemaker, R. et al (2001), p.37.

<sup>40</sup> Genes are not microorganisms and neither, under a narrow definition, are cell lines although, for example, the UK Patent Law considers the latter to be microorganisms. See UK Patent Office Manual of Patent Practice Section 1.40. See also, Adcock, M. & Llewelyn, M. (2000) "*Microorganisms, Definitions and Options under TRIPS*", Occasional Paper 2, QUNO, Geneva.

<sup>41</sup> See Glossary for definition.

<sup>42</sup> IUPGR Resolution 5/89. Source: <http://www.mtnforum.org/resources/library/iupgr91a.htm>

<sup>43</sup> IUPGR Resolution 4/89

<sup>44</sup> Text of the ITPGR. Source: <http://www.fao.org/ag/cgrfa/IU.htm>

<sup>45</sup> ITPGRFA Article 18.5

<sup>46</sup> ITPGRFA Article 12.3 d)

<sup>47</sup> A contractual agreement between the supplier and recipient of material setting out the conditions governing the transfer.

