European Intellectual Property Review

2007

Crop breeding and intellectual property in the global village

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Subject: Intellectual property. **Other related subjects:** Agriculture. International trade

Keywords: Biodiversity; Developing countries; International trade; Patents; Plant varieties; Treaties

Legislation: International Convention for the Protection of New Varieties of Plants 1991
Agreement on Trade-Related Aspects of Intellectual Property Rights 1994 (WTO)

***E.I.P.R. 167** In the past years the subject of intellectual property rights (IPRs) has acquired more and more importance and has become a fundamental topic in debates about globalisation and economic development. As is known, the primary justification for the establishment of IPRs is economic. By offering a temporary monopoly for the commercial exploitation of an innovation, IPRs tend to provide an incentive for creative endeavours by inventors and authors.

Increased interest has been given in the past few years to strengthening IPRs in crop breeding. The number of countries that grant IPRs is growing, the types of inventions that can be protected are expanding, and the scope of protection offered by IPRs systems in different countries has also broadened. The relevance of IPRs for plant breeding and the seed industry is being further enhanced by the development of plant biotechnology, which engendered patents for genes, tools and processes that are increasingly common part of modern plant breeding.[1]

The use of IPRs in plant breeding--especially in developing and least developed countries--raises a number of important issues, including food security and biodiversity conservation, smallholders' access to technology, the possible monopolisation of genetic resources, the relevance and admissibility of follow-on research, the growth of the domestic private seed sector and the status of farmer-developed varieties. Moreover, the development of new plant varieties has always relied to some extent on public research, partly in response to the traditional public good nature of crop germoplasm, and it is believed that the application of IPRs to the products of a publicly funded endeavour might be problematic.[2]

It is therefore worthwhile to write a few words on the two main international treaties related to IPRs in crop breeding, i.e. the Convention for the Protection of New Varieties of Plants (UPOV Convention)[3] and the Agreement on Trade-related Aspects of Intellectual Property Rights (TRIPs Agreement) of the World Trade Organization (WTO).[4] Both treaties have played and are playing a major role in increasing worldwide the level of intellectual property protection in plant breeding.

The UPOV Convention

The UPOV Convention requires that each member country must adopt national legislation to give plant varieties legal protection. That means that whoever creates a new plant variety (i.e. the breeder) must be given an adequate legal protection, such protection consisting of the possibility for the breeder to prevent others from commercially exploiting the new variety.

By providing plant variety protection (PVP), the UPOV Convention should aim to encourage the development of new varieties of plants, for the benefit of society at large. In particular, this treaty should contribute to the well-being of the population by contributing most particularly to (1) food security and availability (by the increase in quantity, quality and diversity of foodstuffs); (2) sustainable agriculture (for example, by a more efficient use of available resources and inputs or by the use of pest and disease resistant varieties); and (3) protection of the environment and biodiversity (for example, by reducing pressure on natural ecosystems through better productivity of cultivated lands, and increase in species diversity).[5]

This article will now examine the most important provisions of the UPOV Convention in order to (try to) verify whether the above-mentioned targets are being met by adopting UPOV-like systems.

A plant variety is protectable under the UPOV system if it is distinct, uniform and stable (so-called DUS criteria). In particular, “uniformity” and “stability” are very relevant requirements. First of all, a

protectable variety must be sufficiently uniform in its essential characteristics. Moreover, the stability requirement is a temporal one, requiring the breeder to show that the essential characteristics of its variety are homogeneous over time, even after repeated reproduction or propagation. The author notes, therefore, that uniformity and stability are the two factors which make PVP biased towards plant breeding for industrial agriculture.

However, the above requirements have been criticised by commentators as discouraging variability in plant varieties that are often useful for sound agricultural ***E.I.P.R. 168*** practices, and as denying protection to breeders of cultivated landraces that exhibit diversity traits and are adapted to the needs of local farmers.[6] Some scholars and non-governmental organisations, therefore, fear that the UPOV system--contrary to its stated purposes--is capable of reducing plant genetic diversity by rewarding breeders of uniform plant varieties, which can represent a shift towards non-sustainable monoculture systems.

Moreover, some do not agree that UPOV-like systems orient plant breeding towards food security. For example, in Zimbabwe more than 70 per cent of all PVP applications filed as of 1999 were on industrial or “cash” crops, such as ornamentals, fibres, oilseed and tobacco, and only 30 per cent covered what can be classified as food crops.[7] In Kenya, by May 1999, of the 140 PVP applications approved, only one was on a food crop: more than 90 per cent of the PVP certificates were for flowers, while the rest went to coffee, sugarcane and barley for the beer industry.[8]

Furthermore, as is known, the 1991 and last version of the UPOV Convention strengthened the rights of breeders (as compared to the earliest versions of 1961 and 1978), bringing about major changes in PVP: such an evolution has been curiously labelled as a case of “legislative Darwinism”.[9]

In particular, unlike the 1978 version, the 1991 treaty expressly states that PVP must be extended to plant varieties which are (1) merely discovered and then developed by the breeder (and not only created); (2) essentially derived from protected varieties; (3) moreover, the 1991 version strongly limits the so-called “farmers' privilege”.

Mere discovery

This first issue is very important. In other words, the last version of the UPOV Convention rewards and protects activities merely consisting of discovering and further developing varieties already existing in nature.

The author fears that this provision (and in particular the term “developing”) might be interpreted by plant variety offices and legislators as meaning that the relevant protection is granted without requiring breeders who discover new varieties to carry out a particularly “creative” action (such as hybridisation or selective propagation).[10] In the author's opinion such an interpretation would not be consistent with the basic principle governing intellectual property systems, according to which--as mentioned earlier--IPRs tend to provide an incentive for “creative” endeavours by inventors and authors. The author fears that countries (especially the biodiversity-rich ones)--whose national legislator or plant variety office interpret the provision at issue in such a way--are exposed to a major risk, i.e. the progressive monopolisation of plants which are already existing in nature and known and thus should belong in the public domain (as is stated by the UN Convention on Biological Diversity of 1992).[11]

Derived from protected varieties

The second issue is also important. UPOV ‘91 extends the breeder's exclusive ownership rights to essentially derived varieties (which was not provided in the 1961 and 1978 versions). On the one hand, the drafters of the 1991 version said that this provision was necessary to prevent a second generation of breeders from making merely “cosmetic” changes to existing varieties in order to claim protection for a new variety. On the other hand, some commentators have pointed out that--by preventing second generation of breeders from developing new plant varieties which are essentially derived from protected ones--the UPOV system is liable to stifle research activities in the agricultural sector. This appears to be particularly true if we think that ongoing progress in crop breeding often depends on the possibility of accessing existing genetic resources and further developing the same: as has been pointed out, “a new plant variety cannot be created from scratch”.[12]

Limitation of the farmers' privilege

The 1991 version of the UPOV Convention, moreover, strongly limits the “farmers' privilege”. The farmers' privilege is the right of farmers who have purchased a seed of a protected variety to save seeds from the resulting harvest for planting in the subsequent season; moreover, under some legislations, farmers' privilege includes the right, not only to replant, but also to exchange and sell certain quantities of seeds for reproductive purposes.

Unlike the 1978 Act, the 1991 version does not authorise farmers to sell or exchange seeds with other farms for propagating purposes. This limitation has been criticised as inconsistent with traditional and age-old practices of farmers in many developing and least developed countries, where seeds are regularly exchanged for purposes of crop and variety rotation[13] ***E.I.P.R. 169*** (crop rotation is considered a wise practice for many reasons, disease avoidance being a major one). In fact, it is believed that food security of many local communities in most developing countries depends largely on their saving, sharing and replanting seeds from the previous harvest (which the 1991 UPOV Convention either limits or prohibits). Moreover these practices--which take place within the same community and are co-operative rather than profit-oriented--appear to be essential to preserve the vitality of the crops across their different generations, and contribute to genetic diversity.[14]

The TRIPs Agreement

The other international agreement which provides intellectual property protection to plant breeding is the TRIPs Agreement. This treaty requires all WTO members to introduce at least a minimum level of protection in their national laws for biotechnological inventions and plant varieties. In particular, Art.27.3(b) of this treaty provides that (1) certain agro-biotechnological inventions must be considered patentable, and that (2) “Members shall provide for the protection of plant varieties either by patents or by an effective *sui generis* system or by any combination thereof”.

Patent rights

As is known, patent rights--being IPRs--have the same rationale and purpose as PVP. Whoever makes a new invention (for example, an agro-biotechnological invention) is given legal protection, such protection consisting of the possibility for the inventor to prevent others from commercially exploiting the said new invention. By providing that, the TRIPs Agreement aims to promote the creation of useful inventions.

In particular, agricultural biotechnology is a technique used by scientists to create, improve or modify plants (e.g. genetic engineering). Several scientists believe that agricultural biotechnology has great economic and humanitarian potential. There might be vast benefits: genetically modified seeds potentially have the ability to combat malnutrition and poverty by creating speciality crops with high productivity, better nutrition value and enhanced resistance to diseases.[15] It is also for these benefits that the TRIPs Agreement made it compulsory to provide patent protection for such kinds of inventions.

However, some commentators underline the possible connection between the patent system and a bias towards centralised agricultural research. They believe, in particular, that patent protection in the agrobiotech sector enhances incentives to develop seeds with a large potential demand and that--to ensure maximum demand for their patented products--biotech companies tend to focus their research on commonly utilised high-value crops and develop varieties that can be cultivated as widely as possible. Therefore some think that the use of patented agro-biotechnological inventions favours centralised crop breeding and the creation of uniform environmental conditions, as well as discouraging agro-ecological research or local breeding tailored to local conditions. The effects of this patent-supported bias towards centralised crop breeding programmes might be, inter alia, decreased crop diversity and decreased spatial genetic diversity.[16]

Plant varieties

As far as plant varieties are concerned, the TRIPs Agreement obliges the WTO Members to provide a form of protection, giving freedom in choosing the appropriate system. States can choose between patent protection, a *sui generis* system or any combination thereof.

It is difficult to precisely identify the *sui generis* system mentioned by Art.27.3(b) of the TRIPs Agreement.

On the one hand, some industrialised countries are of the opinion that the *sui generis* system at issue

should be the one provided by the UPOV Convention, or at least a UPOV-like one.

On the other hand, many developing countries are convinced that--when implementing such provision-- states can devise a system different from a UPOV-based one and consequently balance the interests of plant breeders and society as a whole, including local farmers. In this regard, a good example is the Indian Protection of Plant Varieties and Farmers' Rights Act of 2001, which recognises at the same time the rights of both breeders and farmers.

Moreover, some propose to design a *sui generis* system by adding to the DUS requirements an additional one, i.e. the so-called “value for cultivation and use” requirement (VCU).[17] Defining the VCU requirement would be left to national governments and could be adopted to ensure that breeders contribute to certain national priorities. For example, for a new variety to acquire protection, VCU might require applicants to demonstrate the socio-economic welfare or environmental benefits of the new variety, such as how it might benefit small farmers in terms of enhancing productivity or requiring fewer external inputs.[18]

Other critical considerations

The trend towards increasing intellectual property protection in plant breeding and agro-biotechnology entails other important consequences.

***E.I.P.R. 170** First, private sector research in agriculture has radically increased, driven in part by the possibilities of profits supported by IPRs, especially PVP and patents. The author notes that in the past--e.g. when the Green Revolution took place in the 1960s--crop breeding was carried out mainly by the public sector and especially through public-funded research.

Secondly, the author notes that--also owing to increasing intellectual property protection--the private sector industry has greatly centralised. What was once an industry in which small seed breeders played a major role has now become a global oligopoly dominated by few leading multinational companies. Mergers between agro-biotech companies create even larger firms which together tend to produce an oligopoly that might allow them greater freedom to fix higher prices and--in general--induce them to engage in anti-competitive behaviour.

Moreover, IPRs in plant breeding and agro-biotechnology may entail other serious environmental-related consequences, which might have an impact on sustainability.

For example, it can be noted that seed companies often develop and protect (by either PVP or patents) hybrids and other modern varieties that depend upon applications of external inputs produced and sold by the same companies (such as fertilisers, herbicides and insecticides). It is believed that an excessive use of such agrochemicals--which in some cases turn out to be toxic--might have serious environmental consequences,[19] as well as a strong social and economic impact, especially in developing countries.[20] In particular, these crop-herbicide-pesticide linkages can be considered to represent a shift towards capitalintensive agriculture that increases the costs of farming and may therefore be detrimental to small farmers, and runs counter to the goal of sustainable agriculture.[21] Moreover, these linkages can trigger a vicious circle of billionaire profits in favour of few multinational seed companies and strengthen their (already) dominant positions in international markets.[22]

According to some commentators, it is (also) intellectual property protection that induces breeders to shift to such external inputs (which indeed are often patented) and crop-herbicide-pesticide linkages. However, such an assertion has been easily confuted.[23]

Another relevant issue is the one related to the so-called Genetic Use Restriction Technology (GURT).[24] GURT is a technology which renders it feasible to sell biological organisms (such as seeds and plants) that are unable to be reproduced by the purchaser. In other words, these technologies render the harvested seed sterile. The purpose of GURT--which has been patented--is to prevent farmers from replanting saved seed and thereby to consolidate the seed companies' monopoly.[25] Moreover, when GURT is applied to IP-protected seeds, it provides a means not only of preventing the infringement of IPRs and the application of the rules on farmers' exemption, but also of ensuring the continuation of the monopoly beyond the life of any patent or plant variety certificate. Although GURT technology is not used on a massive commercial scale yet, some commentators point out that its possible application might affect the future of agriculture.

Conclusions

We have seen that IPRs and agriculture--two subjects that once were not so related--are becoming increasingly intimate bedfellows.

In the last years, international standard-setting activities have begun to extend intellectual property protection to plant varieties and agro-biotechnological inventions, i.e. to subject-matter which--at least in many developing and least developed countries--has never been considered protectable through intellectual property law.

The UPOV Convention and the TRIPs Agreement are the results of the above-mentioned international standard-setting activities. Moreover, more and more developing and least developed countries (even the ones which have not adhered to UPOV) are entering into bilateral and regional free trade agreements with industrialised countries, such as the United States, these agreements binding the said countries either to adhere to UPOV '91 or to protect plant varieties through UPOVstyle rules.

As we have seen, the main purpose of intellectual property systems in crop breeding is stimulating the creation of new useful plants and crops, which can bring vast benefits to society at large: for example, genetically modified seeds--with their high productivity and enhanced resistance to diseases--might be a good response to malnutrition in the poor areas of the world.

However, it is important not to underestimate the social, economical and environmental impact of the regulation at issue, especially in developing and least developed countries.[26] This is particularly true if we consider that in these states agricultural activities (which--until few years ago and in certain countries still today--have been carried out mainly by public institutions) are very relevant and socially sensitive, unlike what happens in industrialised countries, where only 5 per cent of the population is involved in crop breeding.

The above confirms that it is very important for the said countries to adopt intellectual property regimes that do not jeopardise the agriculture sector (which still represents their only development-oriented opportunity) and consequently take into consideration also the interests of small farmers and local communities (in this regard, the above-mentioned Indian Protection of Plant Varieties and Farmers' Rights Act of 2001 is a good example).

Moreover, states--in order to avoid the monopolisation of already existing genetic resources--should not legitimise misinterpretations of the above-mentioned UPOV rule, according to which PVP is granted also to varieties which are merely discovered and further developed. In addition, in order to protect farmers' interests, GURT should not be allowed and international treaties should specify and stress such a ban.

It is also very important to maintain the structure of international agro-industrial markets to be as competitive as possible, avoiding an exercise of IPRs which entails abusive behaviour and jeopardises the interest of consumers and farmers.[27] In this regard, national and regional antitrust authorities should intervene in order to prohibit and punish such behaviour. In that way, it is the author's opinion that there might be more chances to meet the above-mentioned UPOV goals, i.e. food security and availability, sustainable agriculture and protection of the environment and biodiversity.

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1. See World Bank, *Agriculture and Rural Development Department, Intellectual Property Rights, Designing Regimes to Support Plant Breeding in Developing Countries,* 2006, at pp.xiii and 1 (available at *http://siteresources.worldbank.org*).

2. *ibid.,* p.2.

3. The acronym UPOV means "Union pour la Protection des Obtentions Végétales". The UPOV Convention was first signed in 1961 and subsequently revised in 1978 and 1991. UPOV is the Geneva-based international organisation which administers the said treaty.

4. As is known, the TRIPs Agreement was signed by all WTO member countries in 1994 and covers all types of intellectual property including patents, copyright and trademarks. It requires IPRs to be protected in all WTO member countries.

5. See the 1999 GRAIN briefing *Plant variety protection to feed Africa? Rhetoric versus reality* (available at *www.grain.org*).

6. See D. Leskien and M. Flitner, "Intellectual Property Rights and Plant Genetic Resources: Options for a Sui Generis System", IPGRI, Issues in Genetic Resources No.6, 1997, pp.51-52 (available at *www.ipgri.cgiar.org*).

7. See the GRAIN briefing, above fn.5.

8. See the 1999 GRAIN document *Upov on the war path* (available at *www.grain.org*).

9. See M. Ricolfi, “La brevettazione delle invenzioni relative agli organismi geneticamente modificati” (2003) I *Rivista di Diritto Industriale* 16.

10. Selective propagation is established where the population of the new variety is different from the population from which the discovered plant originated. See, for example, the Clarifications of Plant Breeding Issues under the Australian Plant Breeder's Rights Act 1994 of December 2002 (available at *www.anbg.gov.au*).

11. One empirical study has documented a pattern of breeders seeking PVP in one state for the “discovery” of a landrace or other traditional variety that is generally known and cultivated in another state. For example, in Australia 37% of the 188 claims offered no evidence of actual plant breeding, lending weight to the criticism that breeders were just “discovering” already known varieties from overseas. See the RAFI report *Plant Breeders' Wrongs Righted in Australia?,* November 1998 (available at *www.etcgroup.org*).

12. See C. Correa, *Intellectual Property Rights, the WTO and Developing Countries. The TRIPS Agreement and Policy Options* (ZED-TWN, London, 2000), p.176.

13. See L. R. Helfer, “Intellectual Property Rights in Plant Varieties: International Legal Regimes and Policy Options for National Governments”, FAO Paper, 2004, p.19 (available at *www.fao.org*).

14. See M. Ricolfi, “Interface between Intellectual Property and International Trade: Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement)”, in *International Conference on Intellectual Property Education and Training (New Delhi, July 11 to 13, 2001)--Collection of Papers compiled by the WIPO Worldwide Academy* (2001), p.80.

15. It has been said that “the great hope for genetically engineered crops is that they will feed the world”. See L. E. Ewens, “Seed Wars: Biotechnology, Intellectual Property, and the Quest for High Yield Seeds” (2000) 23 B.C. Int'l & Comp. L. Rev. 285 at p.295.

16. See G. Dutfield, *Intellectual Property, Biogenetic Resources and Traditional Knowledge* (Earthscan, London, 2004), pp.60-61. However, the said author recalls that the above trend in crop breeding dates back to when the Green Revolution began, and earlier still in some countries, when plant varieties were not granted intellectual property protection, so that IPRs alone cannot be held responsible for the loss of agro-biodiversity.

17. See Leskien and Flitner, above fn.6, pp.54 et seq.

18. See Dutfield, above fn.16, p.62.

19. As far as the UPOV Convention is concerned, there might be a possible link between the DUS criteria and the massive use of external inputs. In this regard, some commentators point out that varieties which meet the DUS criteria tend to require external inputs to compensate for their uniformity, since uniformity over large areas leads to vulnerability on the farm. For example, it has been noted that in the time period 1977-1997 Zimbabwe and South Africa--which in the meantime had implemented PVP systems based on the DUS criteria--tripled their pesticide importation bills. See the GRAIN briefing, above fn.5.

20. This view is not shared by everybody. There are commentators that praise the use of such agrochemicals and conversely doubt that organic farming is better for the environment. The most eminent critic of organic farming is Norman Borlaug, the father of the Green Revolution, winner of the Nobel peace prize and an outspoken advocate of the use of synthetic fertilisers to increase crop yields. He claims the idea that organic farming is better for the environment “ridiculous” because organic farming produces lower yields and therefore requires more land under cultivation to produce the same amount of food. According to this view, thanks to synthetic fertilisers, global cereal production tripled between 1950 and 2000, but the amount of land used increased by only 10%. Conversely, using traditional techniques such as crop rotation, compost and manure to supply the soil with nitrogen and other minerals would have required a tripling of the area under cultivation: the risk would have been the deforestation of the planet. In this regard, see *The Economist,* December 9-15, 2006, pp.71-72.

21. For example, herbicide-resistant crops allow weeds to be killed chemically, rather than plucked manually; this might reduce the demand for farm labour, which is scarce in rich countries, but in need of employment in poor ones. See *The Economist,* September 16-22, 2006, p.90.

22. See E. Bonadio, *La protezione giuridica delle invenzioni biotecnologiche tra TRIPS, Convezione sulla Biodiversit à e UPOV, Rassegna di Diritto Pubblico Europeo--Europa e Biotecnologie* (2004), pp.112-113.

23. See Dutfield, above fn.16, p.62, who recalls again that IPRs are unlikely to be directly responsible for this trend in plant breeding, which dates back at the time of the Green Revolution, when varieties were developed by public crop breeding institutions and were not protected through IPRs.

24. GURT is also known as “Terminator technology”.

25. The owners of the first GURT patent were the US Department of Agriculture and the Delta and Pine Land, a major American cotton seed company. In August 2006 said company was acquired by the agrochemical multinational Monsanto for $1.5 billion, which proves that agro-industrial markets--also because of increasing intellectual property protection--tend to move towards oligopolistic structures.

26. In this regard see also C. Chiarolla, “Commodifying Agricultural Biodiversity and Development-Related Issues” (2006) 9(1) *Journal of World Intellectual Property* 25 et seq.

27. In general, the importance of maintaining the structure of patent-related markets as competitive as possible is stressed by G. Ghidini, *Profili evolutivi del diritto industriale--Propriet à intellettuale e concorrenza* (Giuffrè, Milano, 2001), pp.21 et seq.