Sui Generis Systems for Plant Variety Protection

Options under TRIPS

A Discussion Paper

by *Biswajit Dhar*

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Preface

One concern arising from implementation of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) of the World Trade Organisation (WTO) is its impact on farming communities. In particular, the meaning of four words in Article 27.3(b) – 'effective *sui generis* system' – for plant variety protection (PVP) has exercised many people in developing countries since publication of our earlier report on Trade, Intellectual Property, Food and Biodiversity* in February 1999. In response to concerns expressed by developing country missions to the WTO in Geneva, we have commissioned this discussion paper to examine this issue.

This paper explores various *sui generis* options that WTO Members could exercise in fulfilling their commitments under the TRIPS Agreement. It:

- examines the evolution of the legal regime to protect plant breeders' interests;
- distinguishes between commercial breeding efforts and the efforts made by farming communities in developing new varieties;
- discusses several alternative frameworks for PVP that have either been proposed or adopted;
- raises policy issues stemming from the available evidence on the functioning of PVP in various countries; and,
- identifies the possible contribution of official development assistance (ODA).

The paper is written for policy makers dealing with these issues in relevant government ministries as well as those groups and agencies with a special interest in this area. Our aim is to contribute to informed public debate about, and policy making concerning, intellectual property rights, farming, plant breeding and biodiversity.

*Geoff Tansey, *Trade, Intellectual Property, Food and Biodiversity: Key issues and options for the 1999 review of Article 27.3(b) of the TRIPS Agreement*, Quaker Peace & Service, London, 1999. Available in English, French, German, Spanish and Swedish at http://www.quno.org - click on Geneva pages

The core work of the Quaker UN Office (QUNO) in Geneva on trade, development and intellectual property rights has been supported by the Environmental Intermediaries Programme of Quaker Peace and Social Witness of Britain Yearly Meeting. This programme links traditional Quaker concerns for peace and justice with a concern for the environment. Since February 1999, QUNO has hosted a series of meetings aimed at helping strengthen the capacity of developing countries to safeguard the interests of their people and to bring these countries into dialogue with industrialised countries around issues raised by the review of Article 27.3(b) of the TRIPS Agreement. QUNO has received additional support from other donors in 2001 to expand its work in this area, and gratefully acknowledges the support from the Rockefeller Foundation in funding production of this paper.

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Executive summary

The Agreement on TRIPs requires WTO Members to introduce an "effective *sui generis* system" for the protection of plant varieties. This commitment by WTO Members implies that most developing countries, which, hitherto had not extended intellectual property rights (IPRs) to their agricultural sector would have to do so. They would thus have to adopt intellectual property protection (IPP) regimes more like those prevailing in the industrialised countries.

The adoption of IPRs in agriculture has a recent origin, even in the developed world. The early initiatives to provide legal protection to plant breeders were taken more earnestly in Europe, but it was in the USA that the Plant Patent Act was enacted in 1930. This Act, however, covered only asexually propagated plants (plants not normally sown from seeds), and was thus aimed at excluding the major food species and so prevent the emergence of grain monopolies as discussed in Section 1.

The European plant breeders pushed for plant breeders' rights (PBRs), which were more comprehensive in the coverage of varieties to be granted legal protection. The origins of this movement for IPP for agricultural products go back to the late 19th century growth in the European seed trade and the development of breeders associations, which was followed by various seed control systems and attempts to provide plant variety protection (PVP). Their exertions led finally to the formation of the Union Internationale pour la Protection des Obtentions Végétales (UPOV) or the International Union for the Protection of New Varieties of Plants in 1961, which then represented the consensus among five European countries on how to introduce PBRs.

The UPOV Convention has been amended three times since it came into force in 1968 and now has 50 members, including the USA but only 14 developing countries. While the first two amendments of UPOV, in 1972 and 1978, kept the basic structure almost unchanged, the last amendment in 1991 introduced far reaching changes to the structure of protection, significantly strengthening PBRs and each is discussed in Section 2. The more significant of these are the restrictions on the re-use of seeds, which could have implications for the farming communities using the protected varieties; in addition, the inclusion of essentially dervied varieties (EDVs) affects the ability of breeders to freely use protected varieties for research.

The response of some developing countries to these developments in the UPOV Convention has been the adoption of alternative *sui generis* options for the protection of plant varieties as is discussed in Section 3. Initiatives have been taken both by governments as well as civil society organisations. These *sui generis* options take into consideration the contribution made both by traditional farmers and commercial plant breeders in shaping present day agriculture. Recognition of farmers contribution to agriculture through on-farm innovation has only happened recently, partly stimulated by global initiatives aimed at protecting biodiversity and recognising indigenous knowledge. Farmers Rights, and how to protect them, have become an issue, as has how to make the formal system of agricultural research benefit resource poor farmers.

These options need to be carefully considered in view of the fact that none-too-favourable results have been observed in countries that have provided PBRs as reviewed in Section 4. The prices of seeds have often tended to push upwards, research activities appear to have become concentrated on a few crops and private R&D expenditure does not appear to have been spurred as expected. Besides, strengthening of the breeders' rights as seen in most developed countries in recent years has led to a spate of mergers and takeovers, causing monopoly pressures to build up. Adoption of structures of PVP by the developing countries similar to those prevailing in the developed countries could accentuate the problems for traditional farming communities in the developing world.

In conclusion, the developing world must evolve *sui generis* legislation which takes a balanced approach between farmers, formal plant breeders and giving rights to traditional communities on their genetic resources – as in legislation enacted in India and proposed in Namibia. Official development assistance could help in this process.

1. Intellectual property, plant breeders and farmers

TRIPS Article 27.3(b) states, " ...Members shall provide for the protection of plant varieties either by patents or by an effective *sui generis* system or by any combination thereof."

The framework for agricultural development in developing countries is changing rapidly as a result of major changes in the international regime governing genetic resources. A key element in this change – apart from the Convention on Biological Diversity (CBD) and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR) – is the requirement for WTO Members to extend intellectual property protection (IPP) in agriculture by protecting improved varieties of plants either through an effective *sui generis* system of protection, or by patents or both. This is just one of many requirements of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), which involves far reaching changes in the protection of intellectual property in many developing countries. Most have to amend their existing IPP regimes and adopt ones more like those in the industrialised countries. TRIPS represents a significant step towards the adoption of a more harmonised system of IPP with a wider scope of protection and stronger rights for the owners of intellectual property than previously existed in developing countries.

The evolution of Plant Breeders' Rights (PBRs) has a long and often controversial history. At least two critical questions lay behind the introduction of PBRs as a form of intellectual property rights (IPRs). The first concerned the rationale for introducing IPRs to cover improvements in plant varieties and the second, the form of protection to be adopted. Here, the key consideration was whether or not a patent-like protection was to be extended to new plant varieties. Although the first multilateral system for the protection of PBRs was created through the Convention establishing the International Union for the Protection of New Varieties of Plants (UPOV Convention) in 1961 its origins go back much further[1].

1.1 Setting the stage

" Almost two centuries ago, this breeding by farmers began to disappear because science, technology and economics had made sufficient co-ordinated progress to allow plant breeding to become an independent specialised branch on the supply side of agriculture" .

Cauderon, 1987, p44

Demands to extend IPP to agriculture, in a similar manner to industry, go back to the growth of the commercial seed trade towards the end of the 19th century in several European countries. At this time, breeders associations also started in some countries - the Swedish Seed Association was formed in 1886.

The formation of the International Bureau of the Union for the Protection of Industrial Property, in 1883, provided an incentive for plant breeders to establish their claims for IPP on new plant varieties. This Bureau oversaw the functioning of the Paris Convention, which was the first multilateral agreement aimed at harmonising patent laws. The Convention's final Protocol stated:" The words" industrial property' should be understood in the broadest sense; they relate not only to the products of industry in the strict sense but also to agricultural products (wines, grain, fruit, cattle etc.)"

By the turn of the century, opinion in favour of introducing IPRs in the area of food became less pronounced as concern was expressed about a rise in price because of the exclusive rights granted to a single person[2]. This concern over the creation of monopolies in as basic a commodity as food was raised in other countries, particularly in the USA.

Despite the European initiatives to establish PBRs (Box 1), the USA gave breeders their first set of rights in the Plant Patents Act of 1930. But this Act had a limited coverage with only asexually propagated plants (plants not normally sown from seeds) included, which was intended to exclude the major food species and thus to prevent the emergence of grain monopolies[3]. This early concern mirrors one of today's major considerations for developing countries in excluding agriculture from IPP, with countries like India, for instance, explicitly excluding food from patenting.

The Plant Patents Act gave impetus to the process of acceptance of IPP in agriculture by a larger set of countries with two factors moving the process forwards, eventually to UPOV. The first was the successful enactment of laws protecting the rights of breeders in the Netherlands and Germany. The second was the more active engagement of associations of the beneficiaries of protection: the International Association for the Protection of Industrial Property (AIPPI) and the International Association of Plant Breeders for the Protection of Plant Varieties (ASSINSEL).

[1]The acronym is derived from the Union's French title 'Union Internationale pour la Protection des Obtentions Végétales'. This discussion is largely based on UPOV, 1987

[2]Heitz, 1987

[3]The USA introduced its Plant Varieties Protection Act only in 1970. This Act made plant breeders' rights applicable to the sexually reproducible crops.

Although the two interest groups were both supportive of extending IPP to agriculture, they differed initially on the form of protection they wanted. While AIPPI supported an extension of the patent system, historically employed to cover industrial inventions, ASSINSEL argued for the adoption of an independent system.

A decisive contribution to the eventual adoption of UPOV as a *sui generis* system of PVP was made by the Lisbon Diplomatic Conference on the Revision of the Paris Convention, held in 1958. Although it considered the grant of patents to plant varieties, no action was taken as the general view was that a "special law" was needed for granting IPP on new plant varieties[4].

This seemed to fit the mood of the countries in Europe which met in 1957 at a Conference[5] that led to the adoption of the UPOV Convention four years later, in 1961. The broad contours of what became the Convention were set out in this Conference. It entrusted France with taking care of the continuation of the work[6]. Despite being the first country to introduce IPRs in agriculture, the USA did not become a party to the UPOV Convention[7]. Until 1970, when the USA introduced its Plant Varieties Protection Act, PBR was seen as a Common Market, or at best, West European phenomenon[8]. This form of protection differed from the patent system in several ways (Box 2).

In 1963, a group of countries from Europe adopted the *Convention on the Unification of Certain Points of Substantive Law on Patents for Invention* in Strasbourg. Article 2(b) of the Convention carved out the exceptions allowed in respect of patentable subject matter, which were "plant or animal varieties or essentially biological processes for the production of plants and animals", but

[4]Greengrass, 1989, p 623

[5]The participants included 8 countries: Belgium, France, Federal Republic of Germany, Italy, The Netherlands, Sweden, Switzerland and the UK; two inter governmental organisations, FAO and the United International Bureaux for the Protection of Industrial, Literacy and Artistic Property (BIRPI); and, representatives of three associations of plant breeders. ASSINSEL, International Federation of Seed Trade (FIS) and International Community of Asexually Reproduced Ornamental and Fruit Tree Varieties (CIOPORA)

[6]Heitz, 1987, p 86

1. European attempts at protection

In 1895, Germany set up a seed control system under the Farmers' Union, which was taken over by the German Agriculture Society in 1897. In 1905, a register of newly bred varieties was created. The system allowed breeders to defend their interests in the improved seed directly derived from the crops they or their associates had grown. Subsequent generations of the seed could be freely reproduced by anyone. Many felt this arrangement had little benefit for breeders.

In the early 20th century, some plant breeders such as Louis Blanc, a Swiss horticulturist, suggested granting the breeder sole distribution rights for the variety while also advocating merit certificates issued by a central body. He suggested that while this body carried out tests, the breeder could propagate the variety so that it could be marketed as soon as the certificate was granted. Blanc also argued for establishing an international institution to protect the interests of the seed trade:

> " an international institution of that kind would contribute greatly towards bringing order to the trade in new fruit varieties, at the same time giving researchers the incentive of assured reward and a deserved and guaranteed profit if the novelty is a good one[a]"

Others saw problems arising from the specific character of new plant varieties. In a study published in 1933, the International Bureau referred to the difficulty of describing a variety for the purposes of protection. Some emphasised the need to evolve a system of depositing samples to make identification of new plant varieties easy. However, the Bureau, concluded:

> " The above observations are in no way intended to combat the idea of new plant variety protection. We merely wished to alert those concerned to the question whether that protection should not be made subject to rules different from those laid down for other creations of the human intellect. The raising of the question is moreover timely, as for some years a most interesting movement, both scientific and technical, has been afoot in the agricultural field and has opened up a vast new area of discovery precisely for plant creations[a]"

This is significant for two reasons:

1.The Bureau seemed to favour granting recognition to plant breeders for their contribution in developing new varieties.

2. It hinted that patents were not the best form of IPRs for new plant varieties.

Events in Europe overtook the International Bureau. Czechoslovakia and France followed Germany and introduced a seed control system - in many ways the first step towards IPP in agriculture. Czechoslovakia adopted a relatively simple seed control system by providing recognition to seeds and seedlings whereas France attempted to introduce a more ambitious formal system through a Decree in 1922. The Decree resulted in the introduction of a Register for Newly Bred Plants and set up a Seed Control Committee. Plant breeders could enjoy exclusive rights for 12 years and could, in addition, claim exclusive use of a variety denomination. Multiplication and marketing of the seed was allowed unless the developer of the new variety expressedly disallowed it. However, this Decree only applied to wheat, with the possibility of extending it to other species by order of the Ministry of Agriculture. It did not succeed because, first, the 1922 Decree was never given a legal foundation and, secondly, it did not cover a wide enough range of species.

In 1930, there was an unsuccessful attempt in Germany to introduce PBRs. A draft Seed and Seedlings Law gave protection to breeders and provided for seed certification. The entry of a variety in the register of protected varieties gave breeders several rights. Notably, the varieties were protected for 20 years (with the possibility of extending it to 30) and, the breeders' authorisation was necessary for marketing the derived seed for the first two generations except for potato, where three generations were covered. This right over successive generations was one of the more controversial aspects of the legislation as a result of which it never passed into law. However, provisions extending the rights of breeders over successive generations were finally accepted in the 1991 revision of the UPOV Convention when protection was extended to " essentially derived varieties" .

Source: Heitz, 1987, [a]Quoted in Heitz, 1987, p 67

qualifying that, "this provision does not apply to micro-biological processes and products thereof". It stated," the Contracting Parties shall not be bound to provide for the grant of patents in respect of plant varieties or animal varieties or essentially biological processes for the production of plants and animals". The language of the Strasbourg Convention was reproduced in Article 53 of the Convention on the Grant of European Patents (European Patent Convention), which was formalised in 1973, and has been carried through into the TRIPS Agreement in Article 27.3(b).

In recent years, the debate on the form of IPP has acquired fresh momentum owing to the advent of biotechnology in plant breeding and the grant of the first industrial patent to plants in the ex-parte Hibberd case in 1985 (See box 5).

The initial framework of IPP for plant breeders has been amended on three occasions, to protect better the interests of commercial breeders. The first amendment of UPOV was in 1972, which introduced changes of a procedural nature[9]. The first substantive amendment was carried out in 1978. The second substantive amendment (the third amendment overall) of the UPOV Convention was conceived in 1986 and eventually finalised in 1991 (Section 2.2).

The IPP provided by the UPOV Convention was quite clearly on protecting the interests of commercial plant breeders which grew out of the specific needs of the countries that took the initiative towards UPOV. Thus, while it rewarded commercial plant breeders, the contribution made by farming communities to plant breeding received little attention. Yet, since the dawn of civilisation, farming communities, most of whom are today concentrated in the developing countries, have made improvements in the agricultural system.

1.2 Farmers as innovators

On-farm innovation by farmers has happened continuously since settled agriculture began. However, recognition of this is fairly recent and over the past decade or so, a vast body of literature has been generated, particularly in response to the global initiatives at preserving and conserving bio-diversity and the role of indigenous people in these conservation activities[10]. The purposive selection that farmers engage in is one source of innovation, which is implemented by informal experimentation.

The farmer-innovation process, in which farmers adopt clearly defined criteria to identify the improved varieties they developed, has a certain resemblance to that followed by formal plant breeders. The latter rely on the three-fold criteria of distinctiveness, uniformity and stability (DUS) of the plant varieties they develop to lay claim to PBRs. But similar farmer innovation receives no recognition or reward. The recognition that formal plant breeders receive is facilitated by the extensive codification of their knowledge. The lack of such codification lies at the heart of the relative neglect of the contribution that farmers have made.

One impediment to codification of farmers' knowledge is the nature of the farmer-innovation process. Unlike the formal breeder, who conducts his research under

[7]France convened the Diplomatic Conference in which participation was limited to those states that shared similar concerns over extending protection to plant breeders. The USA, which had provided limited protection to plant breeders only for asexually propagating plants was not included for this reason, see Heitz, 1987, p 82

[8]Mooney, 1983, p 138

[9]In its original form, UPOV membership was divided in three groups based on the extent of contributions they would make. The amendment in 1972 increased the groups of members to five.

[10]See for example IDRC,1994

2. Protection under UPOV '61 and plant patent regime

UPOV '61	Plant patent regime
1. Plant breeders can obtain protection for discoveries	1. Patents only for inventions
2. Criteria for Protection (i) Novelty (ii) Distinct (iii) Homogeneity (iv) Stability	2. Criteria for Protection (i) Novelty (ii) Inventive step involved (iii) Industrial applicability
3. Forfeiture of rights if a protected variety loses its essential expressions of characteristics	3. No corresponding provision
4. Submitting of propagating material to the national authority designated for the purpose necessary in most laws	4. No such requirement
5. Initially covered a small canvas	5. Specified exceptions
6. Flexibility in favour of users (i) " farmers' privilege" (ii) " breeders' exemption"	6. Rigid application to secure rights to patentee (i) dilution of " farmers' privilege" (ii) introduction of EDVs to curb research exemption

Note: The essential structure of UPOV '61 remained almost unchanged till 1991 when major amendments were carried out.

" Farmers select by identifying and using plants of economic importance, continually retaining and reusing seed, and propagating material with preferred characteristics ...The farmer is not moving iteratively towards some optimal point, but is only able to stay in dynamic equilibrium with his environment by continuous innovation"

Biggs and Clay, 1981, p 323

controlled conditions, the farmer uses the available environmental conditions to conduct his experiments. Furthermore, farmers' use of environmental conditions is based on a detailed knowledge of the environment in which they practise their farming. Natural selection occurs" by the action of environmental stress on inherent variation caused by gene recombination and mutation"[11], but this process occurs not only in the plants that are directly useful to humankind but also in other organisms, which directly affect the process of agricultural production. These include weeds, pests and micro-organisms. Farmers reliance on natural selection has resulted in a continuous and evolving process of change in agriculture, and has brought about adaptation within a specific or given environment.

Farmers' future role in the process of agricultural innovation is also important. Various studies have argued that the formal system of research has a distinct rich-farmer bias and, as a result, the vast multitude of poor farmers in most developing countries are unable to benefit from the advances in farm technology. This bias could be rectified, according to Harwood, by involving farmers in research "at all levels and stages and sharing credit for results"[12]. The way to do this, however, is disputed.

Chambers and Jiggins, in an informed overview of early studies on the issue, argue that given the need to focus agricultural research towards the requirements of poor farmers, research priorities should be set by poor farmers themselves. Agricultural research, the authors argue by quoting an earlier study, should begin "with a systematic process of scientists learning from, and understanding, RPF (resource poor farmer) families, their resources, needs and problems. The main locus of research and learning is the resource-poor farmer, rather than the research laboratory". This approach, wherein the RPF families themselves identify priority research issues, is, according to Chambers and Jiggins, "based on respect for and confidence in the ability of RPF families to tell scientists their understanding of the problems they face, and to identify how the formal research system can help them"[13].

A series of case studies conducted since the early 1980s have put farmer innovation in perspective. Many labels have been used to describe this: 'farmer–back–to–farmer', 'farmer–first–and–last', 'farmer participatory research' among others. Other studies have tried to document the key role that the farmer could play in the selection of appropriate varieties for commercial exploitation[14].

Another model of farmer participation that has been used with some degree of success involves the development of technology. This participatory technology development (PTD) approach builds on indigenous knowledge, combining it with external knowledge and inputs only when the farmers themselves perceive the need to do so. An important element of the PTD approach is that it recognises that no single model can carry this process forward. A series of iterative steps are proposed in each case, which include training of facilitators, organising and conducting experiments, implementing and evaluating the results, sharing the results and, finally, sustaining and scaling up of the PTD Process[15].

The idea of a "turn around" in agricultural research is not shared by some other commentators on farmer participatory research. Tripp, for instance, maintains that farmer participation should be central to adaptive agricultural research but argues that re-orientation of research based on the farmers' knowledge system may not be in order[16]. One reason is that RPFs would not be in a position to perform this role. This is, primarily, due to two factors: the poorest are unlikely to develop institutions and informal R&D involves certain costs, which poor farmers may not be able to bear.

Recognition of farmers' contribution to the advancement of agriculture has come at both national and international levels. Developing countries are trying to create the administrative structures that would be necessary to mainstream the farmers' contribution and are taking necessary legislative action. One of the first such efforts has been made by India in enacting the Plant Varieties and Farmers' Right Act. The Organisation of African Unity (OAU) has also developed model legislation for the protection of the rights of farmers and breeders, as well as other local communities, which Namibia has translated into a draft law.

National and regional initiatives have complemented international efforts for the recognition of Farmers' Rights. First proposed in 1989[17], the International Treaty on Plant Genetic Resources for Food and Agriculture has succeeded in developing a broad consensus on various aspects of managing plant genetic resources. This marks a significant step and should serve as a signal for a larger cross-section of developing countries to take legislative action that can protect the rights of farmers.

[11]Biggs and Clay, 1981

[12]Quoted by Chambers and Jiggins, 1986, p14

[13]Chambers and Jiggins, 1986, p17

[14]Chambers et al, 1989

[15]Bunders, 1996

[16]Tripp, 1989

[17]FAO, 1989. For details see Bragdon and Downes, 1998

2. TRIPS, *sui generis* protection and UPOV

Pressures to expand IPP in agriculture have built up globally over the past few decades as private interests have expanded their operations in plant breeding. Moreover, breeding activities which were largely carried out by the public sector have increasingly been taken up by private seed companies[18]. The 1980s saw a further expansion of private sector operations as major transnational corporations like Unilever, ICI, Monsanto and Rohm and Haas, involved in the agrochemical industry, entered plant breeding[19]. This was primarily because these firms aimed to offer agricultural technology as an integrated package, in which improved varieties of planting material were the critical components. Extending IPP was considered as the most effective way in which plant breeders could obtain returns on their investment.

The norms for PVP are specified in the TRIPS Agreement in Article 27.3(b). This states that "... Members shall provide for the protection of plant varieties either by patents or by an **effective** *sui generis* system or by any combination thereof" (emphasis added). A central issue is what 'effective' in fact means.

2.1 What is an "effective" *sui generis* system?

Three interpretations of what can be considered as an "effective" *sui generis* system of plant varieties' protection are given below.

2.1.1 Effective enforcement

The TRIPS Agreement provides an indication of a possible meaning of the term "effective". TRIPS employs the term "effective" in particular in the context of the national enforcement of rights and procedures for the multilateral prevention and settlement of disputes, in which the rights to be conferred by an IPR are either defined in detail, or as "equitable remuneration". This formulation argues that a *sui generis* system needs to allow effective action against any act of infringement, as required by the relevant articles of the TRIPS Agreement. The major limitation of this approach is that the effectiveness of a *sui generis* system thus assessed does not depend on the requirements for, or on the level of, protection[20].

2.1.2 UPOV as an "effective" system

Both the WTO and UPOV secretariats have given clear indications that they would consider the framework provided by UPOV as an "effective" *sui generis* system. Even before the language of the Agreement on TRIPS was finalised, a member of the Secretariat of the General Agreement on Tariffs and Trade (GATT) said that TRIPS would oblige parties to, "provide for the protection of plant varieties, but would leave them free to decide whether to grant such protection through patents, through an effective *sui generis* system such as the UPOV system, or through any combination of the two"[21]. This statement identifies UPOV with an effective *sui generis* system.

The UPOV Secretariat has argued that the "UPOV Convention provides the only internationally recognised *sui generis* system for the protection of plant varieties"[22]. Thus, UPOV expected many developing countries to choose the UPOV system as their model for an effective *sui generis* system of protection[23].

Major associations of plant breeders, like ASSINSEL, have also argued in favour of the UPOV framework. For ASSINSEL, a *sui generis* system for protecting plant varieties can operate only if varieties are defined in terms of uniformity, stability and distinctness. Without these qualities, any variety is "vague and evanescent, quite unsuitable for being the subject matter of a legal right". The adoption of these three criteria for granting protection to plant varieties by the UPOV Convention makes it the effective system according to ASSINSEL[24].

UPOV has also been identified as an effective *sui generis* system in the proposals on IPRs made in the draft Agreement of the Free Trade Area of the Americas (FTAA). According to these proposals, "Members shall grant protection to plant varieties, through patents, through an effective *sui generis* system, such as the system of the International Union for the Protection of New Varieties of Plants – UPOV, or through a combination thereof"[25].

[18] Smith, 1996

[19] Sehgal, 1996

[20] Leskien and Flitner, 1997

[21] Statement made by Matthijs Gueze in the Diplomatic Conference for the Revision of UPOV held in 1991, see UPOV, 1992 para 74.2, p 180

[22] UPOV, 1998

[23] FTAA, 2001

[24] ASSINSEL, nd1

[25] FTAA, 2001

2.1.3 Protection available as indicator of "effectiveness"

Here, the availability of protection for new plant varieties is the sole determinant of effectiveness for the *sui generis* system. Accordingly, the legal framework that can provide protection to the largest range of new varieties developed can alone be considered an "effective" system. This criterion can only be met if protection is extended to include all the stakeholders involved in plant breeding in various countries, ie, formal plant breeders - the focus of UPOV - and traditional farmers who continue to play a significant role in the development of agriculture across countries.

India has followed this interpretation (see section 2.3.1). The Protection of Plant Varieties and Farmers' Rights Act was approved by the Indian Parliament in August 2001 and is arguably the only *sui generis* system for plant varieties' protection other than the UPOV Convention currently enacted in law. The Indian legislation provides protection to varieties developed by plant breeders in the formal sector as well as farmers, besides safeguarding the traditional rights of the latter to save seeds from one year's harvest to be used in the next.

2.2 Features of UPOV systems of protection

There are three alternative systems of protection of plant varieties under the UPOV Convention - the 1961 Act (with the 1972 amendments), the 1978 Act and the 1991 Act. The 1961/72 and the 1978 Acts are essentially similar, while the 1991 Act makes fundamental departures from the earlier ones. Over the past decade, the UPOV membership has changed character. From 18 developed countries in 1991, UPOV had a membership of 50 countries at different stages of development early in 2002. (Box 3).

2.2.1 UPOV 1961

This Convention (UPOV '61) adopted by five countries had several key provisions:

(i) Forms of protection

Each member state could recognise the right of the breeder by the grant of a special title or of a patent. But countries whose national law allowed protection under both these forms were allowed to use only one of them for the same botanical genera or species. This provision followed the recommendations made by a Group of Legal Experts on the relationship between the Paris Convention for the Protection of Industrial Property and the proposed UPOV in 1960. The experts said that "while each country should remain entirely free to choose the system of protection that it adopted for domestic legislation, it is desirable that in each of them, for one and the same species or group of species, there should be just one category of protection"[26]. This provision became a major impediment to the USA joining UPOV since after 1970, plant varieties could be protected both by the Plant Patents Act of 1930 and the Plant Varieties Protection Act of 1970.

(ii) Coverage of varieties

UPOV '61 applied to all genera and species mentioned in the Annex to the Convention[27] but in a phased manner. Each Member was expected to apply the

[26]Heitz, 1987, p 87

[27]Included in the list were wheat, barley, oats or rice, maize, potato, peas, beans, lucerne, red clover, rye grass, lettuce, apples, roses or carnations

3. Changing nature of UPOV membership

Belgium, France, the Federal Republic of Germany (FRG), Italy and the Netherlands were the original signatories on 2 December 1961. UPOV came into force only in August 1968 after the UK, the FRG and the Netherlands had ratified it. Of the five original signatories, France ratified it and joined the Union in 1971, Belgium in 1976 and Italy in 1977. Switzerland also joined in 1977; Sweden, Israel and South Africa became members during the 1970s.

Between 1980 and 1983, six countries joined UPOV, including the USA after an amendment in the 1978 Act. Thus, 17 members of UPOV and Australia, which joined in 1989, effectively negotiated the critical amendments for the 1991 Act.

By January 2002, the membership had expanded to 50. Of these, 14 are developing countries. All are parties to the 1978 Act except the Republic of Korea, which acceded to the 1991 Act. Since 1991, 11 Eastern European countries and former Soviet Republics have also become UPOV members and eight of these have acceded to the 1991 Act.

A striking feature about the membership is the high proportion of countries with relatively low shares of their economically active population in agriculture. At the end of 1999, only seven had more than 25 per cent of their workforce in agriculture and just two, China and Kenya, exceed 50 per cent. Most of the early members of UPOV have less than 5 per cent of their economically active population engaged in agriculture. There seems to be a strong correspondence between adoption of IPP in agriculture and low shares of economically active population in this sector.

provisions of the Convention to at least five of the genera mentioned in the Annex upon joining, then to the other genera in the list in three phases, that is, (a) within three years to at least two further genera, (b) within six years, to at least four further genera and (c) within eight years to all the genera included in the Annex. Importantly, the genera and species listed were significant in Europe and in countries of the temperate climatic zone[28].

(iii) Scope of protection

Prior authorisation from breeders had to be sought for production and commercial marketing of the reproductive or vegetative material, as such, of the new variety, and for the offering for sale or marketing of such material.

The breeders' rights extended to ornamental plants or parts of plants marketed for purposes other than propagation when they were used as propagating material in the production of ornamental plants or cut flowers. Breeders' authorisation was required only if the new varieties were used as an initial source of variation in creating new varieties or for marketing such varieties. In other words, the use of the varieties for research purposes was allowed.

The framework developed in UPOV provided the minimum standards of protection, and any member State could provide a higher level of protection to the new varieties, even extending the breeders' rights to the marketed products.

(iv) Duration of protection

A minimum of 18 years protection for vines, fruit trees and their root-stocks, and 15 years for all other plants were provided. Member States could adopt longer periods of protection and could fix different periods for some classes of plants to take into account the requirements of regulations concerning the production and marketing of seeds and propagating materials.

(v) Conditions for protection

The 1961 Act allowed protection of varieties that were (a) new, (b) distinct, (c) homogenous and (d) stable. These attributes of plant varieties that could be granted protection were elaborated in the Model Law that UPOV developed after the 1978 Act was finalised (see below).

2.2.2 UPOV 1978

Moves to revise UPOV began in 1974, ostensibly to make the convention more attractive to non-members. The needs of two countries in particular, the USA and Canada, were addressed in the revision of the convention. Two sets of conditions for PVP had to be met under UPOV '78 . The first was the minimum number of genera or species to which any UPOV member state had to extend protection in their national legislation. The second related to the characteristics of the plant varieties that could qualify for protection.

(i) Number of genera/species to be protected

Initially, the provisions had to apply to at least five genera or species. Within three years, this number had to increase to 10 and after a further three years to 18[29]. Within eight years, at least 24 genera or species had to be covered. The number of genera or species to be included could be reduced, or the period allowed for meeting the requirements of coverage increased, if particular members of UPOV were unable to comply with the stipulations due to "special economic and ecological conditions"[30]. These provisions, included in Article 4, were a radical departure from the corresponding provisions of the 1961/72 Act which identified a list of genera or species suited to the needs of European countries. Article 4 was thus provided to remove one of the major obstacles to the adherence of several non-European States to UPOV[31].

(ii) Conditions for protection

UPOV '78 allowed protection of plant varieties (Article 6) that were: (a) new, (b) distinct from any other variety that was in common knowledge (c) sufficiently homogenous and (d) stable in their essential character. Any plant variety that met these criteria could qualify for protection, irrespective of the origin, artificial or natural, of the initial variety from which it had resulted (Box 4). This implies that unlike patents, which are normally not granted to discoveries, plant varieties could be protected even when they were "discovered".

[28]UPOV, 1981
[29]Article 4(3)
[30]Articles 4(4) and 4(5)
[31]UPOV, 1981

4. UPOV '78 conditions for protection

Novelty
This differs from that applied to industrial patents in two ways. First, with patents, most countries applied the criterion of novelty anywhere in the world, ie absolute novelty, while under UPOV, the novelty criterion may be applied strictly in a national context, ie local novelty. Secondly, patent protection could be extended to products and processes that were not marketed as of the day of the application for protection, but a plant variety could be considered as new provided the variety must not :

- have been offered for sale or marketed in the country in which protection was being sought for more than one year,
- have been offered for sale or marketed in any other country for more than four years in the case of all plant varieties except for vines, forest trees, fruit trees and ornamental trees when the period was not more than six years.

The first criterion for defining novelty was the result of an amendment made to the 1961/72 Act. The 1961/72 Act allowed protection of only "new" varieties of plant, which is akin to the criterion of novelty applied to patentable subject matter.

The Model Law of UPOV '78 suggests that the criteria of novelty proposed in Article 6(i)(b) does not specify the type of material the offering or sale of which would be detrimental to the conditions of novelty. The Model Law indicates that the national legislations of UPOV member states could expressly state that it is not only the offering for sale, or the marketing of the propagating material of the variety, but also the offering for sale, or the marketing of other material of the variety (including derived products) that could be considered as offering for sale or marketing, of the variety. The latter interpretation of novelty could, in fact, bring UPOV '78 closer to the industrial patent system.

Distinctness
This criterion was designed to complement that of novelty in that the protectable variety was required to be clearly distinguishable from any other variety whose existence was common knowledge. Common knowledge could be established by reference to factors like (i) cultivation or marketing (ii) inclusion of the variety in an official register of varieties, and (iii) description in a publication. The Model Law, however, indicated that these factors were not exhaustive and this left UPOV '78 open to interpretation in identifying the distinctness of a variety.

Homogeneity
This criterion was applied to the sexual reproduction of the varieties or their vegetative reproduction.

Stability
To be stable, a plant variety had to remain true to its initial description after repeated reproduction or propagation.

(iii) Nature of protection

UPOV '61 allowed countries to protect the interests of plant breeders, either through the grant of a special title or a patent but not both. The USA, however, had extended protection to sexually propagating plants through the Plant Variety Protection Act of 1970 besides providing for plant patents.An amendment in Article 37 paved the way for the accession of the USA to the treaty by including an exception to Article 2(1), which allowed a state already providing dual protection to continue to do so provided "it notifies the Secretary General (of the UPOV) of that fact". Furthermore, countries using the patent laws to protect plant varieties were allowed to use the patentability criteria and the period of protection as was provided for under their patent laws.

Thus, this amendment allowed countries to provide more than one form of protection for plant varieties only if the countries were maintaining such a system prior to their entry into UPOV. It is because of this condition that only the USA has been able to provide for multiple forms of protection to plant varieties.

(iv) Scope of breeders' rights

The rights provided, as spelt out in Article 5(1), allowed breeders control over the following activities associated with reproductive or vegetative propagating material: (a) production for the purposes of commercial marketing, (b) offering for sale, and (c) marketing. In addition, the breeders' authorisation had to be obtained when plants of the protected varieties or their parts, normally marketed for purposes other than propagation, were commercially used as propagating material in the production of ornamental plants or cut flowers of that variety.

Article 5(4) states that any member of UPOV "may grant to breeders a more extensive right" than set out in Article 5(1), "extending in particular to the marketed product". Thus UPOV 78 sets only the minimum standards for PBRs for its members. Thus, UPOV provided the benchmark, an approach followed by in the TRIPS Agreement[32].

Article 5(3) provided an important exception to the PBRs. This said authorisation of the breeder was not required "either for the utilization of the variety as an initial source of variations for the purpose of creating other varieties or for the marketing of such varieties". However, authorisation of the breeder was required when "repeated use of the variety was necessary for the commercial production of another variety".

While it defines the scope of the PBRs, Article 5 also provides the basis for balancing these rights with the interests of the users of the plant varieties. Farmers and

[32]Article 1 of the Agreement in TRIPs provides that "Members may, but shall not be obliged to, implement in their law more extensive protection than is required by this Agreement, provided that such protection does not contravene the provisions of this Agreement"

researchers were provided the space to carry on with their activities unhindered by the exercise of the PBRs. Farmers were allowed to continue their tradition of using a part of a year's harvest as seeds for the next and also to exchange seeds with their farm neighbours. These activities of farmers, often referred to as the "farmers' privilege" , were not considered as a part of "commercial marketing" under Article 5(1).

A research exemption was also clearly spelt out in Article 5(3), since no authorisation of the breeder was required for the use of a protected variety "as an initial source of variation for the creation of other varieties". This provision, it can be argued, also provided space for the farmer innovators who could develop new varieties and also market them.

(v) Safeguarding public interests

Article 9 of UPOV '78 allows the exclusive rights of breeders to be restricted in the public interest. The Model Law of UPOV '78 offers three interpretations of Article 9: through the grant of a voluntary licence by the right holder for the exploitation of the variety; licences of right; and, compulsory licences.

Voluntary licences or contractual licences, the term that the Model Law uses, can be provided by any breeder for the exploitation of his variety on terms agreed between the parties. A similar structure has been suggested in the Model Law of the grant of licences of right that could be issued by the relevant authority. The licensee has to apply for exploitation of a protected variety and also register his intent of paying a royalty to the breeder before the licence can be issued. These licences do not reflect on the public interest dimension. Also, the structure of licences of right as suggested here essentially differs from those that have been used in the patent laws of several countries where few discretionary powers were left to the right holder as they had to allow grant of a licence for the exploitation of a patent once an application proposing exploitation was made.

The compulsory licensing provisions in the Model Law articulate the public interest dimension providing that the "Plant Breeders' Rights Office shall grant the compulsory licence if this is necessary to safeguard the public interest in the rapid and wide distribution of new varieties and in their availability to the public at adequate and reasonable prices". Several conditions must be fulfilled, namely:

- the applicant for a compulsory licence must be in a position, both financially and otherwise, to exploit the PBR in a competent and business-like manner;
- the applicant was refused permission by the right holder to produce or market the propagating material of the protected variety in a manner sufficient for the needs of the general public;
- the applicant could not procure a licence for exploitation of the variety on reasonable terms;
- three years have elapsed between the time of the grant of the PBR and the application for the grant of the compulsory licence; and,
- the compulsory licence shall not, under ordinary circumstances, be granted for less than two or for more than four year.

These provisions for the grant of compulsory licences differed from those in the patent laws of several countries, in particular over the term allowed for the exploitation of plant varieties. Unlike a compulsory licence for the exploitation of a patent, which was usually granted for the entire period for which the patent was valid, compulsory licences here could be granted for a maximum period of four years.

These provisions for the grant of compulsory licences thus shifted the balance in favour of the right holder. Several of the conditions for the grant of compulsory licence, as indicated above, were adopted when the patent laws were strengthened in the Agreement on TRIPS.

2.2.3 UPOV 1991

The decision to revise the provisions of the 1978 Act was taken in 1986. The 17 members took this decision at a time when biotechnology was increasingly being used for plant breeding activities, which prompted demands for the adoption of the patent system in agriculture. These demands were strengthened after the first industrial patent was granted for an improved crop variety in the USA (Box 5)

The main goal of the revision was to strengthen the breeders' right. The reason, as argued in the Diplomatic Conference for the Revision of UPOV Convention, was that

the "costs of deploying new technologies and the costs of developing and producing new varieties" of plants had "caused the public authorities in the UPOV member states to ask themselves if the plant breeders' rights system was adequate and strong enough to secure the maintenance of the enormous, costly breeding work"[33]. It was argued that the authorities of the member states were convinced of the need to have a strong plant breeding industry, backed by a strong PBRs system, together with strong organisations for the protection of genetic resources.

Breeders' associations like ASSINSEL lent support for the revision of UPOV. In its 1988 conference, the organisation resolved:

- That, given the strengthening and other improvements which are currently being considered in the UPOV Convention, the UPOV Convention and corresponding national PBR laws should provide the most satisfactory and appropriate system of protecting plant varieties.
- That the patent system appears generally ill-suited for protecting plant varieties and that therefore plant varieties should be protected only by PBR[34].

The members of the Conference accepted UPOV '91 after the Diplomatic Conference held in Geneva. The Act required a minimum of five ratifications and accessions coming into force as an international legal instrument and this was achieved in April 1998. After the Republic of Korea became a member in January 2002, 19 members of the UPOV Convention had acceded to the 1991 Act.

There are key differences from UPOV '78 in three areas: (a) the coverage of varieties qualifying for protection, (b) the nature of rights enjoyed by the breeder and, (c) the rights over "essentially derived varieties" (EDVs).

(i) Coverage of varieties

Until 1991, members had flexibility in the coverage of genera and species subject to PBRs – in part due to concerns about the impact of PBRs on genetic diversity[35]. Till then, varietal protection could be adopted by member countries in a phased manner and did not require comprehensive coverage of all varieties.

UPOV '91 requires a comprehensive coverage of plant varieties by the member states, but not immediately. States that have been members of the Convention have a five year transition period to meet this requirement[36]. New members to the Union, however, are required to protect 15 genera or species on accession and include all genera and species within 10 years[37].

(ii) Nature of rights enjoyed by the breeder

UPOV '91 marks a major departure from UPOV '78 in the nature of rights provided to the breeder. Article 14 defines these in four areas: (a) the propagating material, (b) the harvested material, (c) certain other products, which are discussed below, and (d) EDVs, which are discussed separately.

[33]UPOV, 1992, p 165
[34]Greengrass, 1989, p 628
[35]Paroda, R S, 1990, p 151
[36]Article 3(1)
[37]Article 3(2)

Breeder's rights on propagating material include: (a) production or reproduction (multiplication), (b) conditioning for the purposes of propagation, (c) offering for sale, (d) selling or other marketing, (e) exporting, (f) importing, and (g) stocking for any of the purposes referred to above.

Propagating material, as understood in UPOV '91, included "parts of the plant

5. Patents on life forms

In 1980, the US Supreme Court gave a landmark judgement that brought living objects under patentable subject matter in the USA. The Diamond v Chakrabarty case ruled by a 5-4 majority in favour of granting patent protection to a bacterium that Chakrabarty, a microbiologist, had developed.

The court ruled that the bacterium was a patentable subject matter under the US Patents Act, thereby setting aside the previous US practice that living matter was not patentable. One of the key considerations of Justice Berger, while delivering the judgement, was that the grant of the patent would provide incentives for research. The Judge said: "Whether respondents' claims are patentable may determine whether research efforts are accelerated by the hope of reward or slowed by want of incentives, but that is all".

This ruling allowed subsequent interpretation of the US Patents Act and the extension of patentable subject matter to plants. The first patent granted to a plant was to a corn plant which contained an abnormally high level of an amino acid. The US Patent and Trademark Office had rejected the application on the ground that utility patent protection of plants was not available since these could be covered by the Plant Patent Act and the Plant Variety Protection Act. However, in 1985 the Board of Patent Appeals and Interferences ruled in this case, now known as the Ex parte Hibberd case, that the corn plant could qualify for utility patent protection.

intended for the production of new plants, for example seeds", and certain parts of plants that may be used either for "consumption or sowing". Of particular importance was "conditioning for the purposes of propagation" covered by Article 14(1)(ii). This was intended to strengthen PBRs by monitoring on-farm production and the use of harvested material . If, for instance, a variety was being cultivated for consumption but during the growing period the farmer decided to use the harvested material, after "conditioning for the purpose of propagation", the breeder can intervene at the conditioning stage using these rights. This leaves virtually no possibility of farmers re-using seeds without the authorisation of the breeder (but see (iv) following).

The rights of the breeder over the propagating material have been extended to all acts involving commercialisation. Besides offering for sale or marketing of the protected propagating material, rights that were provided under UPOV '78, UPOV '91 extends PBRs to exporting, importing and stocking. Inclusion of exporting as an additional right for breeders, makes UPOV in its present form stronger in terms of the rights it affords than the patent system does under the TRIPS Agreement.

PBRs were further strengthening by extending them to harvested material and products of harvested material that use protected varieties of plants. Article 14(2) states that" … in respect of harvested material, including entire plants and parts of plants, obtained through the unauthorized use of propagating material of the protected variety shall require the authorization of the breeder, unless the breeder has had reasonable opportunity to exercise his right in relation to the said propagating material". This article, in essence, puts the burden of proof on the users of planting material to prove their innocence that they did not use a protected variety in the event that they are challenged by the owner of the variety. The significance of this provision was seen in a recent dispute involving Monsanto and a Canadian farmer, Percy Schmeiser where the latter had claimed that he did not plant a Monsanto-owned plant variety as was claimed by the company. The case (Box 6) was eventually settled in favour of Monsanto, leaving Schmeiser to compensate the seed company.

Rights over the products of the harvested material were again extended to breeders through a provision similar to the one in the case of harvested material. Breeders would have rights over the harvested material if they can establish that they did not have adequate opportunity to establish their rights in relation to the harvested material.

(iii) Essentially derived varieties

The inclusion of EDVs in UPOV '91 is generally regarded as the single most important change to UPOV. Under this provision, the so-called "research exemption" available under UPOV '78, which allowed breeders to freely use protected varieties for research purposes and for breeding new varieties, was excluded. This has major ramifications for developing countries where farmer-innovators have been an integral part of the innovation systems (Section 1.2). Article 14(5), which provides for the inclusion of EDVs of protected varieties within PBRs, seeks to strengthen the rights of the breeder by bringing within protection "essentially derived and certain other varieties" of the protected varieties.

Proponents of the change argued that the benefits that a breeder could secure were limited since the "research exemption" available under UPOV '78 allowed the creation of a new variety of plant by using protected varieties without the authorisation of the original breeder[38]. The association of commercial plant breeders, ASSINSEL, supported the introduction of the EDV concept since, "cosmetic modifications", according to them, were enough for protecting a new variety, particularly in the mutation of ornamental or fruit plants and of "conversion" by repeated backcrossing of parental lines of hybrid varieties. It may be argued that Article 14(5) was introduced to limit development of new varieties from the protected varieties by any means.

An EDV is defined as:

- it is predominantly derived from the initial variety, or from a variety that is itself predominantly derived from the initial variety, while retaining the expression of the essential characteristics that result from the genotype or combination of genotypes of the initial variety,
- it is clearly distinguishable from the initial variety, and
- except for the differences, which result from the act of derivation, it conforms to the initial variety in the expression of the essential characteristics that result from the genotype or combination of genotypes of the initial variety.

[38]Articles 5(3) of UPOV '78 allowed use of a protected variety as an initial source of variation for the purposes of creating other varieties

Article 14(5) further[39] provides a non-exhaustive list of examples of acts that may result in the essential derivation, including the selection of a natural or induced mutant, or of a somaclonal variant, the selection of a variant individual from plants of an initial variety, back-crossing or transformation by genetic engineering. This indicates that all acts of breeding, from the most conventional to those involving use of modern techniques, would be taken into consideration while determining whether or not a new variety is "essentially derived".

This strengthening of the PBRs was quite controversial, with several countries, notably Japan and Canada, raising the issue in the Diplomatic Conference. These countries emphasised that prior to the assigning of rights for an EDV, effective guidelines must be laid down for identifying such varieties[40]. UPOV '91 took note of this observation through a decision to evolve some guidelines but these have not yet appeared. The Canadian delegate pointed out that the provisions on EDVs were controversial since varieties that were previously considered new would be treated as essentially derived after these provisions were applied and hence could not be exploited commercially without the consent of the breeder of the initial variety. One of the solutions suggested by ASSINSEL is the establishment of thresholds for characterisation of EDVs by adopting the following principle[41]:

- A first threshold below which a variety cannot be considered an EDV should be specified for each species and a second threshold of conformity above which the variety should be considered as essentially derived. These thresholds should be used if the breeder cannot prove, by clear evidence, that he has started from an independent germplasm.
- Between these two thresholds, the derivation could be disputable and the breeder of the EDV should have to give, in case of amicable negotiation or arbitration, information on the origin of the new variety[42].

[39]Article 14(5)(c)

[40]UPOV, 1992, paragraphs 1119, 1126, pp 347-48

[41]ASSINSEL, nd2

[42]For a seed industry perspective see Smith, 1996

6. Percy Schmeiser vs Monsanto

Percy Schmeiser, a farmer residing near Bruno in Saskatchewan, Canada, was involved in canola (oilseed rape) farming for more than 40 years. In 1998, Monsanto Canada Inc claimed that Percy Schmeiser had illegally planted "Roundup Ready Canola", a seed tolerant of glyphosphate herbicides, which was the subject matter of Canadian patent number 1,313,830 owned by Monsanto US. Monsanto Canada brought the case before the Federal Court of Appeal as a licensee. Monsanto claimed that Mr Schmeiser had not signed a "Technology Use Agreement" with the company, which gave farmers the right to grow the plants containing the patented gene, before growing it on 1030 acres.

The claim for damages made by Monsanto Canada were: (i) $15,450 in general damages on account of land seeded for canola (at the rate of $15 per acre of land, which was in accordance with the terms of the Technology Use Agreement), (ii) $105,000 to be paid to the patent owner, Monsanto US (which was the value of the disputed crop), and (iii) $25,000 for punitive and exemplary damages.

Monsanto Canada based its claims on its investigations in the summer of 1997 through a private investigating agency. The agency undertook random audits of canola crops growing in Saskatchewan farms, including that of Mr Schmeiser's. This investigation indicated that "Roundup Ready Canola" was being grown on Schmeiser's fields, where it was not licensed.

Mr Schmeiser, in his defence, argued that he was using his own strain of canola and that his general practice was to use chemical herbicides as little as possible. The canola farmer pointed out that if his crop was found to contain the patented gene this was the result of contamination which had occurred for various reasons. These included: "cross field breeding by wind or insects, seeds blown by passing trucks, or dropping from farm equipment, or swaths blown from neighbours' fields".

The court turned to the opinions of three experts, Dr Keith Downey, appearing for Monsanto, Ms Doris Dixon, who was responsible for four tests done on seed and leaf samples from canola growing on lands farmed or adjacent to lands farmed by Mr Schmeiser, and Dr Barry Hertz, a mechanical engineer, whose evidence related to the distance that canola seed blown from trucks in the road could spread.

The evidence provided by the experts made a significant impact on the ruling given by the court. Judge W. Andrew Mackay said:

> "I am persuaded on the basis of Dr. Downey's evidence that on a balance of probabilities none of the suggested possible sources of contamination of Schmeiser's crop was the basis for the substantial level of Roundup Ready canola growing in field number 2 in 1997".

He also said:

> "In the result, I find on a balance of probabilities, and taking into account the evidence of Ms. Dixon about the genetic testing of the samples of the defendants' 1998 canola crop, that by growing seed known to be Roundup tolerant and selling the harvested seed, the defendants made use of the invention without permission of the plaintiffs..."

Mr Schmeiser's case is a pointer to the nature of control that seed companies can exercise over farming activities using the leverage they obtain through IPRs. The nature of the rights plant breeders enjoy under UPOV'91 would make it easier for rights holders to exercise control over harvested material, and also products of the harvested material, if the rights holders claim that they are unable to exercise their rights over the infringing farmer, as Monsanto did in the Schmeiser case.

Source: Monsanto Canada Inc and Monsanto Company and Percy Schmeiser and Schmeiser Enterprises Ltd., Judgement by Judge W. Andrew MacKay, Ottawa, Ontario, March 29, 2001

Others have argued that the determination of derived varieties would not be made by an examining office as a part of the grant of PBRs, but between plant breeders either through a mutually arrived agreement or through litigation[43]. This implies that this critical issue would be settled by the relative strengths of the parties involved which would not favour developing countries[44].

(iv) Exceptions to PBRs

Two sets of limited exceptions to PBRs are included in Article 15 of UPOV'91. The first (Article 15.1), designated as compulsory exceptions, include: (a) acts done privately and for non-commercial purposes, (b) acts done for experimental purposes and (c) acts done for the purpose of breeding other varieties, provided that such breeding activities did not result in the production of EDVs. Included in this set of exceptions is a more restricted version of "research exemption" available under UPOV '78.

The second set of optional exceptions (Article 15.2) includes those that are related to "farm saved seed" or the "farmers'privilege". This provision states that each "Contracting Party may, within the reasonable limits and *subject to the safeguarding of the legitimate interests of the breeder*, restrict the breeders' right in relation to any variety in order to permit 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…" (emphasis added).

This is in sharp contrast to the earlier system under which farmers were allowed to re-use protected material without paying any royalty to commercial breeders. The new provisions allow farmers to re-use protected material only if the "legitimate interests of the breeder" are taken care of - the "legitimate interests" being the royalty that the breeder should be paid and this meant "downgrading of the farmers' privilege" in the view of the UN's Food and Agriculture Organisation[45].

The Model Law of UPOV '91 has suggested further limitations on the exercise of the farmers' privilege. Article 15.2 of UPOV'91 should be used only in relation to varieties of "specified plant genera and species" and not to all genera and species covered by the domestic legislation of UPOV member countries. This, the Model Law states, was inconsistent with a Recommendation adopted in the Diplomatic Conference that adopted the 1991 Act, which said that Article 15.2 of UPOV '91 "should not be read so as to be intended to open the possibility of extending the practice commonly called "farmer's privilege" to sectors of agricultural and horticultural production in which such a privilege is not a common practice on the territory of the Contracting Party concerned".

ASSINSEL interpret this recommendation[46] to mean that "farmer's privilege" should not go "beyond the provision of the 1991 Act of the UPOV Convention, ie, within the reasonable limits in terms of acreage, quantity of seed and species concerned and subject to the safeguarding of the legitimate interests of the breeders in terms of payment of a remuneration and information". Any national legislation authorising farm saved seed without reasonable limit and without safeguarding the legitimate interests of the breeders, ASSINSEL argue, "would not be an effective *sui generis* system in the meaning of Article 27.3(b) of the TRIPS Agreement".

The restrictions farmers could face in the new system are illustrated by the amendment of the PBRs made by the US Congress after ratifying UPOV '91. This put limits on the scope of the "farmer's exemption" under the US Plant Variety Protection Act (the US equivalent of PBRs) - farmers are allowed to re-plant the seeds on their own farm but are restricted from selling them for reproductive purposes to their farm neighbours without having to pay royalties or ask permission for the same.

(v) Contractual licences and the public interest

UPOV '91 allows restrictions on the exercise of PBRs to safeguard public interest in article 17. This Article, in essence, is similar to the corresponding provisions in UPOV '78. The similarities extend to the interpretations of these provisions in the respective Model Laws. In both, the suggested remedy for violation of the public interest is the grant of contractual licences. However, unlike the interpretation of UPOV '78, which had provided three options for contractual licences, the Model Law of UPOV '91 provides only two options - either voluntary licences or compulsory licences.

The provisions of compulsory licences for UPOV '91 have certain nuanced differences from those of UPOV '78. The most important of these is that while the latter defines the grounds for safeguarding public interest[47] the former does not

[43]Greengrass, 1993. In a subsequent personal communication, the author has reported that the extension of the right to cover essentially derived varieties is expected to be limited to those varieties which take over virtually the whole of the genome of the protected variety. In matters of dispute this may therefore require scientific evidence, referred to in Cohen, Crespi and Dhar, 1998

[44]For an earlier account of the plant breeding programmes in India see Mukherjee and Lockwood, 1973 and Agrawal, 1980. More recent developments in this area have been detailed in the annual reports of the Indian Council of Agricultural Research (ICAR)

[45]UPOV, 1992, para 858.2

[46]ASSINSEL, nd3

[47]Rapid and wide distribution of new varieties and their availability to the public at adequate and reasonable prices are the grounds on which public interest is defined

7. States party to UPOV*

State	Date became member	Latest Act to which State is party and date it became so		1999 farm population(%)[a]	State	Date became member	Latest Act to which State is party and date it became so		1999 farm population(%)[a]
Argentina	25-Dec-94	1978 Act	25-Dec-94	12.1	Kyrgyzstan	26-Jun-00	1991 Act	26-Jun-00	26.3
Australia	1-Mar-89	1991 Act	20-Jan-00	4.7	Mexico	9-Aug-97	1978 Act	9-Aug-97	22.1
Austria	14-Jul-94	1978 Act	14-Jul-94	5.3	Netherlands	10-Aug-68	1991 Act[g]	24-Apr-98	3.5
Belgium[b]	5-Dec-76	1961/1972 Act[c]	5-Dec-76	1.9	New Zealand	8-Nov-81	1978 Act	8-Nov-81	9.1
Bolivia	21-May-99	1978 Act	21-May-99	46.8	Nicaragua	6-Sep-01	1978 Act	6-Sep-01	20.8
Brazil	23-May-99	1978 Act	23-May-99	23.3	Norway	13-Sep-93	1978 Act	13-Sep-93	4.7
Bulgaria	24-Apr-98	1991 Act	24-Apr-98	7.5	Panama	23-May-99	1978 Act	23-May-99	20.8
Canada	4-Mar-91	1978 Act	4-Mar-91	2.4	Paraguay	8-Feb-97	1978 Act	8-Feb-97	38.9
Chile	5-Jan-96	1978 Act	5-Jan-96	18.8	Poland	11-Nov-89	1978 Act	11-Nov-89	22.2
China	23-Apr-99	1978 Act[d]	23-Apr-99	67.5	Portugal	14-Oct-95	1978 Act	14-Oct-95	13.2
Colombia	13-Sep-96	1978 Act	13-Sep-96	26.6	Republic of Korea	7-Jan-2002	1991 Act	7-Jan-2002	10.6
Croatia	1-Sep-01	1991 Act	1-Sep-01	9.1	Republic of Moldova	28-Oct-98	1991 Act	28-Oct-98	23.7
Czech Republic	1-Jan-93	1978 Act	1-Jan-93	8.5	Romania	16-Mar-01	1991 Act	16-Mar-01	15.9
Denmark[e]	6-Oct-68	1991 Act	24-Apr-98	3.9	Russian Federation	24-Apr-98	1991 Act	24-Apr-98	10.8
Ecuador	8-Aug-97	1978 Act	8-Aug-97	33.3	Slovakia	1-Jan-93	1978 Act	1-Jan-93	9.3
Estonia	24-Sep-00	1991 Act	24-Sep-00	11.6	Slovenia	29-Jul-99	1991 Act	29-Jul-99	2.2
Finland	16-Apr-93	1991 Act	20-Jul-01	5.7	South Africa	6-Nov-77	1978 Act	8-Nov-81	9.9
France[f]	3-Oct-71	1978 Act	17-Mar-83	3.5	Spain[h]	18-May-80	1961/1972 Act	18-May-80	7.7
Germany	10-Aug-68	1991 Act	25-Jul-98	2.6	Sweden	17-Dec-71	1991 Act	24-Apr-98	3.3
Hungary	16-Apr-83	1978 Act	16-Apr-83	11.1	Switzerland	10-Jul-77	1978 Act	8-Nov-81	4.3
Ireland	8-Nov-81	1978 Act	8-Nov-81	10.5	Trinidad and Tobago	30-Jan-98	1978 Act	30-Jan-98	8.9
Israel	12-Dec-79	1991 Act	24-Apr-98	2.8	Ukraine	3-Nov-95	1978 Act	3-Nov-95	14.9
Italy	1-Jul-77	1978 Act	28-May-86	5.6	United Kingdom	10-Aug-68	1991 Act	3-Jan-99	1.8
Japan	3-Sep-82	1991 Act	24-Dec-98	4.3	USA	8-Nov-81	1991 Act[i]	22-Feb-99	2.2
Kenya	13-May-99	1978 Act	13-May-99	75.9	Uruguay	13-Nov-94	1978 Act	13-Nov-94	14.2

*** UPOV = International Convention for the Protection of New Varieties of Plants**

Source: UPOV, UPOV Convention (1961), as revised at Geneva (1972, 1978 and 1991), Status on January 7, 2002

Notes: [a] Economically active population in agriculture in 1999
[b] With a notification under Article 34(2) of the 1978 Act
[c] States Party Member to the 1961 Convention and the additional Act of 1972
[d] With a declaration that the 1978 Act is not applicable to the Hong Kong Special Administrative Region
[e] With a declaration that the Convention of 1961, the Additional Act of 1972, the 1978 Act and the 1991 Act are not applicable to Greenland and the Faroe Islands
[f] With a declaration that the 1978 Act applies to the territory of the French Republic, including the Overseas Departments and Territories
[g] Ratification for the Kingdom in Europe
[h] With a declaration that the Convention of 1961 and the Additional Act of 1972 apply to the entire territory of Spain
[i] With a reservation pursuant to Article 35(2) of the 1991 Act

explicitly do so. But although the Model law of UPOV '91 does not define the public interest explicitly, it can be argued that the structure of UPOV '91 does not limit the grounds for defining public interest and compulsory licences could be broader in their scope of application than under UPOV '78.

Although existing members retain the flexibility of adopting the framework of protection provided either by the 1961/72 Acts or the 1978 Act, according to their needs (Box 7), new members of UPOV can accede only to the 1991 Act. An issue that is yet undecided is the period within which all existing members of UPOV would have to accede to the 1991 Act. The 1978 Act, however, can be used as a model by countries adopting legislations to protect plant varieties, but these countries would not be granted membership of UPOV if the 1991 Act is not used as the model law.

3. Other options

Many countries, such as India and Namibia, have shown their interest in developing alternative *sui generis* systems. While India's legislation has entered into the country's statute books, the Namibian legislation is still awaiting approval. These initiatives aside, NGOs have also tried to develop *sui generis* options for protecting plant varieties. The Convention of Farmers and Breeders (CoFAB), developed by Gene Campaign, an India-based organisation, represents one such effort.

3.1 Indian legislation on plant varieties protection

Indian legislation to fulfill its commitments under TRIPS Article 27.3(b) is the Protection of Plant Varieties and Farmers' Rights (PPVFR) Act. This legislation is an attempt by the Indian Government to recognise the contribution of both commercial plant breeders and farmers in plant breeding activity. It is the outcome of twin pressures on the Government - one set from the world system to introduce IPP to recognise commercial plant breeders' contribution in the development of new varieties, which was reinforced by the emerging private seed industry in India, and the other from farming communities opposed to the introduction of any form of IPRs in the agricultural sector. The private seed industry in India argued for the introduction of IPP to cover the agricultural sector ever since its entry on a major scale was facilitated following the amendment of the Seed Act in 1988, which provided greater space to the private sector to operate in the industry. The main argument of the seed companies was that incentives for supply of improved varieties of seeds could only be provided by appropriate IPRs.

The farmers, however, were beneficiaries of the breeding activity undertaken by publicly funded institutions, which from the mid 1960s had provided the improved varieties of seeds that made the Green Revolution in India a reality. These publicly funded institutions did not depend on IPRs; their activities were determined by government policy making. The balance, however, shifted in favour of extending IPRs in agriculture after India assumed membership of the WTO.

3.1.1 Overview of the legislation

(i) Objectives

The PPVFR Act aims to establish "an effective system for the protection of plant varieties, the rights of farmers and plant breeders, to encourage the development of new varieties of plants", in line with Article 27.3 (b) of TRIPS. Three key aims are:

- protection of the rights of farmers for their contribution made at any time in conserving, improving and making available plant genetic resources for the development of new plant varieties,
- protection of PBRs to stimulate investment for research and development, both in the public and private sector, for the development of new plant varieties, and
- giving effect to Article 27.3 (b) of the TRIPS Agreement on PVP.

(ii) Coverage of varieties

Sections 14, 23 and 29 of the Act specify the range of plant varieties that can be protected. Section 14 lists three classes of varieties: (a) new varieties, (b) extant varieties, and (c) farmers' varieties. For new varieties, the genera and the species, which can be registered under the PPVFR Act will be notified subsequently by the Central Government. This implies that the Indian Government will restrict the number of genera and species protectable under the Act to an, as yet, unspecified number. Once notified, no genera or species would be deleted from the notified list except in the public interest. Extant varieties have been defined using four benchmarks: (a) varieties that have been notified under the Seeds Act, 1966, (b) farmer varieties and (c) varieties about which there is common knowledge or (d) any other variety that is in the public domain. Farmers' varieties, however, have been defined as (a) varieties that have been traditionally cultivated and evolved by farmers in their fields and (b) a wild relative or landrace of a variety about which farmers possess common knowledge. Section 14 thus provides opportunities to all the stakeholders in plant

breeding, in the main, farmers and commercial plant breeders, to seek protection for the plant varieties that they develop.

Breeders can exercise their rights over any variety that is essentially derived from the protected variety. An EDV is defined in the PPVFR Act as having one of the following characteristics: (a) predominantly derived from an initial variety while retaining the expression of the essential characteristics that results from the genotype or combination of the genotype of such initial variety, (b) any variety that is not clearly distinguishable from a protected variety, or (c) conforms to such initial variety in the expression of the essential characteristics that result from the genotype or combination of genotype of such initial variety. This is similar to that in UPOV '91.

(iii) Conditions for protection

Section 15 specifies the characteristics of the varieties that qualify for protection - distinctness, uniformity and stability. Thus, the legislation has followed the principles set by the UPOV Convention and each characteristic has been defined as therein.

(iv) Conditions imposed on applicants

Section 18 requires any applicant intending to register for protection of a plant variety in India to make a series of declarations and also provide information about the origin of the genetic material that the variety uses. The imposition of these conditions is significant given the on-going discussions on the review of Article 27.3(b) in the TRIPS Council of the WTO and in the World Intellectual Property Organisation (WIPO) Intergovernmental Committee on Intellectual Property, Genetic Resources, Traditional Knowledge and Folklore.

Applicants must declare that (a) the variety for which protection is sought does not contain any gene or gene sequence involving terminator technology[48] (Box 8) and that, (b) the genetic material or parental material acquired for breeding, evolving or developing the variety has been lawfully acquired. Applicants must provide the complete passport data of the parental lines from which the variety has been derived along with the geographical location in India from where the genetic material has been taken. Applicants will also have to provide all information about the contribution, if any, of any farmer, village community, institution or organisation in the breeding, evolution or development of the variety and also information on the use of genetic material conserved by any tribal or rural families in its breeding [Section 40 (i)]. The above conditions will not, however, apply to the registration of farmers' varieties.

(v) Rights of breeders

Breeders' rights recognised under the PPVFR Act extend, for seed and/or propagating material of the protected variety, to: (1) production, (2) selling, (3) marketing, (4) distribution, (5) export, and (6) import [Section 28(1)]. These rights are consistent with those that have been provided under UPOV '91. However, if the breeder's variety protected under the Act is an EDV from a farmer's variety, the breeder cannot give any authorisation without the consent of the farmers or communities from whose varieties the protected variety is derived [Section 43].

[48]This step taken by the Indian government appears to be consistent with the state of the debate on seeds that are based on Genetic Use Restriction Technologies (GURTs), more commonly known as the terminator seeds. See for instance, FAO 2001

(vi) Farmers' rights

Chapter VI of the Act, on Farmers' Rights, contains specific provisions to safeguard the interests of farmers and other village and local communities engaged in plant breeding in two ways: first, by protecting their on-farm activities and secondly, by providing incentives in the form of rewards for their contribution to farming.

Two specific provisions protect on-farm activities. Firstly, the farmer will be

8. Terminator seeds

In 1998, the Delta and Pine Land Company, and the US Department of Agriculture obtained a patent on a new genetic technology designed to produce sterile seeds. These seeds, better known now as "terminator seeds", were the products of Genetic Use Restriction Technologies (GURTs). There are two general applications of GURTs. The so-called "terminator seeds" were the Variety-specific GURTs or V-GURTs, which could be used to restrict the propagation of the plant. The trait-specific GURTs or T-GURTs, also called "traitor technology", could be used to obtain an added value from the use of the seeds developed by using this technology with the help of specific inducing compounds. The use of seeds using GURTs could have far reaching implications for farmers. While V-GURT seeds might make farmers totally dependent on the market for seeds, the T-GURT seeds could make them dependent on the agro-chemical affiliates of breeding companies for supply of the inducing compounds.

Article 9.2 ...each Contracting Party should... 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.

FAO, Commission on Genetic Resources for Food and Agriculture, International Treaty on Plant Genetic Resources for Food and Agriculture, November 2001

"entitled to save, use, sow, re-sow, exchange share or sell his farm produce including seed of a variety protected" under the legislation "in the same manner as he was entitled before the coming into force" of this legislation[49]. This provision, in essence, is what has been known as the "farmers' privilege", an accepted practice under UPOV '78, which UPOV '91 severely diluted. The Act, however, imposes a condition on the farmer that the seeds farmers are entitled to sell cannot be branded. Although, this requirement may not appear too demanding, the definition of "branded seed" in the legislation could impose restrictions on farmers. "Branded seed", according to the Act "means any seed put in a package or any other container and labelled" in a manner indicating that the seed is of a protected variety. Whether or not this qualification on the so-called "branded seeds" will affect the farmers' ability to engage in brown–bagging will be the key issue during implementation of the Act.

The second provision concerns the full disclosure of the expected performance of the seeds or planting material by the plant breeder. Where these fail to perform in the manner claimed by the breeder, the farmer may claim compensation from the plant breeder. This provision appears to exceed the limits that plant varieties' legislation normally provide and transgresses into the domain of the Seed Act - the relevant legislation for verifying the quality of seeds.

The PPVFR Act also seeks to reward the farmer "who is engaged in the conservation and preservation of genetic resources of land races and wild relatives of economic plants and their improvement through selection and preservation". This provision, when taken in conjunction with the provisions relating to the farmers' privilege, is similar to the concept of "Farmers' Rights" contained in the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR).

(vii) Researchers' rights

Researchers' rights are recognised in Section 30 which grants them free and complete access to protected materials for research use in developing new varieties of plants. However, authorisation of the breeder is required "where repeated use of such variety as parental line is necessary for commercial production of such other newly developed variety"[50]. This provision in effect uses the formulation provided for in UPOV '78 for breeders' exemption.

(viii) Benefit sharing

The Act provides for benefit sharing involving registered varieties in two circumstances. The first applies specifically to EDVs [Section 26]. In the second, any village local community can claim benefit for contributing to the development of a variety registered under the Act [Section 41].

For a variety registered as an EDV, NGOs or individuals can claim a share of benefits that may arise from its commercialisation on behalf of any village or local community. The Plant Varieties and Farmers' Rights Authority, the designated authority to implement the Act, to whom the claims for benefit sharing must be made, will investigate claims and indicate the amount of benefit sharing if justified. The Authority will use two criteria to establish the justification of the claims. These are: (a) the extent and nature of the use of genetic material of the claimant in the development of the variety for which benefit sharing has been claimed, and (b) the commercial utility and demand in the market for the variety. The amount of benefit sharing, if any, would have to be deposited in the National Gene Fund by the breeder of the variety.

In the second circumstance, any individual or NGO can make a claim on behalf of a village or local community for the contribution that they had made in the evolution of any variety registered under the Act. If, upon investigation, the claim was found justified, after the breeder was given an opportunity to file objection and to be heard, an amount of compensation as the Authority deems fit would be deposited by the breeder in the National Gene Fund.

(ix) Compulsory licensing

An important feature of the Act is the priority attached to the public interest over the interests of the commercial breeders [Chapter VII]. The legislation authorises the granting of compulsory licences to ensure availability of seed plant or reproductive material of the protected variety in reasonable quantity at reasonable price if:

- three years have elapsed since the date of issue of a certificate of registration,

[49]Section 39(1)(iv) of the PPVFR Act

[50]Section 30 of PPVFR

- reasonable requirements of the public for seeds or other propagating material of the variety have not been satisfied, and
- the seed or other propagating material of the variety is not available to the public at a reasonable price.

If these conditions exist, the Plant Varieties and Farmers' Rights' Authority can intervene. If, after giving an opportunity to the breeder of such a variety to file an opposition and, after hearing the parties, the Authority may, on grounds (b) and (c), order the breeder to license any one interested in undertaking production, distribution and sale of the seed or other propagating material of the variety.

The Authority will determine the period for which compulsory licences are granted in each case, taking into consideration the gestation periods and other relevant factors and will also give due consideration to the interests of the plant breeder. The terms and conditions of a compulsory licence should ensure:

- reasonable compensation to the breeder of the variety under the compulsory licence taking note of the nature of the variety, the expenditure incurred by the breeder in developing it and other relevant factors, and
- that the compulsory licensee can provide farmers the seeds or other propagating material of the variety in a timely manner and at a reasonable market price.

The Act attempts to take on board the contributions made by the different stakeholders in plant breeding. Arguably this system is consistent with the TRIPS Agreement because first, the TRIPS Agreement does not define an "effective" *sui generis* system for PVP, and secondly, there are no limitations on members providing protection to farmers as well as protecting plant varieties[51].

Plant breeders belonging to the formal sector are, however, critical of the Indian legislation. According to ASSINSEL, the "Indian Bill mixes PBRs and FRs (Farmers' Rights), which are two different issues. Their association in a single text is not obvious since they could have been addressed separately in two different pieces of law. Moreover, as far as the Indian Bill is concerned, it is our opinion that the protection provided to plant breeders is definitively not effective"[52].

Apart from potential opposition from plant breeders in the formal sector, the challenge for the PPVFR Act will be when it is implemented. Effective implementation will require the establishment of a well co-ordinated network of institutions. The degree of success that India is able to demonstrate in its implementation should provide the basis for adoption of similar legislation in other countries.

3.2 Namibian legislation

In August 2001, *sui generis* legislation for the protection of plant varieties was introduced into the Namibian Parliament. It is based on 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" developed by the OAU. The proposed, "Access to Biological Resources and Associated Traditional Knowledge Act" provides for the grant of FRs and PBRs, while recognising the rights of local communities over their biological resources and associated knowledge, innovations and practices.

3.2.1 Plant breeders' rights

The following provisions would apply to plant breeders:

(i) Scope of protection

All plant varieties that are new, stable and homogenous in their essential characteristics would be protected. These three criteria are based on UPOV '78.

(ii) Rights given

Plant breeders would have the exclusive right to produce and sell, plant or propagating material of the protected variety. However, in selling the product, the proposed legislation does not clarify whether the act of selling would be restricted to Namibian territory or includes exports. Breeders would also have the right to license others to sell or produce the protected plant varieties or their propagating material.

(iii) Duration of protection

The proposed PBRs are 20 years for annuals and 25 years for trees, vines and other perennials from the date the rights are granted.

[51] This implication has been provided by Leskien and Flitner, 1997

[52] Personal correspondence with Mr. Patrick Heffer of ASSINSEL

(iv) Exceptions

Breeders' rights would not apply when farmers save, exchange or use a part of the seed from the first crop of plants which they have grown for sowing on their own farms to produce a second and subsequent crops. In addition to this, plant breeders would not be able to exercise their rights in:

- propagating, using and growing plants of the protected varieties for non-commercial purposes;
- selling plants or propagating material of the protected varieties as food or for another use that does not involve growing of the plants or the propagating material of the protected varieties;
- selling within a farm or any other place where plants of the protected varieties are grown;
- using plants or propagating material of the protected varieties as initial sources of variation for the purposes of developing new plant varieties, except when repeated use of the protected varieties are made for commercial production of another variety;
- sprouting the protected varieties as food for home consumption or for the market;
- using protected varieties in breeding, research or teaching; and,
- obtaining protected varieties from gene banks or plant genetic resource centres.

(v) Restrictions

The Government would be able to restrict the rights of the breeder in the public interest. A non-exhaustive list of acts that may require intervention includes restrictions that may be imposed for:

- controlling anti-competitive practices;
- preventing any adverse effect on food security or nutritional or health needs;
- checking inordinate import of the protected varieties;
- redressing the situation where the requirements of the farming community for propagating material are not met; and
- promoting public interest arising out of socio-economic reasons and for developing indigenous and other technologies.

Whenever such restrictions are imposed, the relevant Government authority would have the right to convert the exclusive rights granted to the plant breeders into non-exclusive compulsory licence of rights.

Breeders would be entitled to a specific amount of compensation if their rights are restricted. Although the mechanism for establishing the amount has not been spelt out, the rights holders would be able to appeal against the compensation award.

(vi) Revocation of PBRs

Four grounds for revocation are given: (a) if a plant variety was not new or if facts existed, which if known prior to the grant of the rights, would have resulted in the refusal of the grant, (b) if the rights holder has failed to pay the fees 90 days after being notified that the prescribed fee was due for payment, (c) the rights holder has failed to comply with the conditions for the PBRs, and (d) the person to whom the rights have been transmitted or assigned has failed to comply with the provisions of the proposed legislation.

3.2.2 Farmers' rights

This legislation recognises FRs stem from the enormous contributions that local farming communities have made in the conservation, development and sustainable use of plant and animal genetic resources. FRs aim to provide incentives to farming communities to continue making these contributions to agriculture and include the right to:

- protect traditional knowledge relevant to plant and animal genetic resources;
- obtain an equitable share of benefits arising from the use of plant and animal genetic resources;
- participate in the decision making processes on matters related to the conservation and sustainable use of plant and animal genetic resources;
- save, use, exchange and sell farm saved seeds/propagating material; and,

- use new breeders' varieties to develop farmers' varieties.

Farmers' varieties would be protected under the rules of practice as found in and recognised by the customary laws and practices of the local farming communities. Farmers would not be able to sell their farm saved seeds in the seed industry on a commercial scale.

3.3 Convention of Farmers and Breeders

Proposed by the Gene Campaign, the CoFAB is designed as a covenant between farmers and breeders belonging to the germplasm-owning countries of the South. It aims to ensure farmers have their rights stemming from the contribution that they have made towards identification, maintenance and refinement of germplasm while at the same time providing protection to the breeders of new plant varieties. It illustrates a contrasting way of balancing the rights of the farming communities and breeders. The proposed Namibian legislation gives primacy to the interests of the farming communities and provides measures to realise this whereas CoFAB provides relatively greater importance to the contribution made by the plant breeders in the formal sector. The main features are:

(i) Coverage of varieties

CoFAB is designed to be applied to all botanical genera and species and these should all be protected within 10 years of the adoption of the Convention. In this respect, CoFAB follows UPOV '91, which also directs member countries to provide comprehensive protection to all varieties of plants within a specified period.

(ii) Conditions for protection

Protectable varieties must be new, stable in the essential characteristics and homogenous. These characteristics have been defined similarly to UPOV '78. The varieties must meet two further conditions. First, the breeders have to declare the origin of all varieties used for the breeding of new varieties. Secondly, breeders are expected to base the new variety on a broader rather than a narrower genetic base, to maintain greater genetic variability in the field. These two conditions are together intended to enhance the sustainability of the genetic base of the gene-rich countries

(iii) Rights given

CoFAB proposes to give rights to charge breeders a fee every time a landrace or traditional variety is used for breeding or improving a new variety. The PBR includes prior authorisation for the production, commercial and branded marketing of the reproductive or vegetative propagating material, and for offering for sale or marketing of planting material that has been granted protection. For ornamental plants, the PBRs extend to parts of the plants marketed for purposes other than propagation, eg cut flowers. An optional clause was that for certain botanical genera or species, the PBRs could extend to the marketed products. The rights that the breeders can enjoy under CoFAB are clearly more extensive than are generally available under UPOV '91.

(iv) Period of protection

The farmers' rights proposed under CoFAB can extend for an unlimited period. For breeders, a minimum period of 18 years is proposed for vines, fruit trees and their rootstocks, ornamental trees and forest trees. For all other plants, the minimum period would be 15 years. The duration of protection available to the farmers and breeders are hardly distinguishable in CoFAB. This is because instead of the usual practice followed in legislation for PBRs where the maximum period of protection is indicated, CoFAB imposes a restriction only on the minimum period.

4. Implications of IPRs in agriculture

Studies on the implications of extending IPRs to agriculture have looked primarily at the economic impact and that on biodiversity. The more relevant studies, particularly on the economic impact, have used developed country experiences as the basis[53].

4.1 Economic impact

Views on this issue are often quite polarised. Proponents of PBRs argue that their introduction provides the incentives needed by breeders to develop better planting material, which, in turn, benefits the agricultural sector by increasing productivity. They also argue that the productivity gains realised through the use of improved varieties of seeds make direct or indirect contributions to the sustainability of agriculture[54].

Others point to several negative implications. These arise primarily from the control over the market that large firms can bring to bear in the exercise of their rights. This issue is particularly significant for developing countries and their small farmers.

4.1.1 IPRs and new varieties: evidence from the UK and USA

The UK and USA offer some evidence although somewhat better information is available for the USA than the UK. Between 1965 and 1995 in the UK, 810 applications for PBRs were filed for winter wheat and 248 were granted. The number of grants of PBRs increased from 33 in 1965-69, to 55 between 1990 and 1995[55].

The figures for the Plant Variety Protection Certificates issued for the new crop varieties in the USA under the Plant Variety Protection Act (PVPA) of 1970 are more dramatic[56]. Between 1971-91, 992 certificates were issued, a more than six-fold increase from the 153 issued between 1971-74. Almost a third of the total between 1971-94 were issued from 1991-94. The largest increase - almost nine-fold - between 1971-74 and 1991-94 was for field crops[57]. Vegetables registered a four-fold increase.

A significant proportion of the Certificates was issued to a small number of crops - almost 53 per cent for field crops from 1971-94 were for new soya bean and corn varieties. Another 28 per cent were for wheat and cotton varieties; thus, 81 per cent of the total certificates were issued to just four crops[58]. Secondly, strengthening the PVPA in 1980 did not increase breeders enthusiasm to register more varieties. But from 1895, the option of seeking protection using utility patents on plants[59] was available (Box 5).

From this limited evidence it seems that there is a tendency for research activities to become concentrated on a few crops. Some breeders have suggested that plant breeding activity in some of the non-hybrid seeds, like soya beans, increased after the PVPA of 1970. For others, the incentives provided by the Act seemed small[60].

4.1.2 Productivity growth and IPRs: the empirical basis

Various estimates of the productivity gains from new plant varieties in some of the industrialised countries have been made. In the USA, yield increases in various crops before 1930 averaged less than 1 per cent per year. Between 1942 and 1992, corn yields increased at an annual rate of 3 per cent, wheat by 2 per cent and soya bean by 1.3 per cent. A large part of this yield increase was attributed to plant breeding. Plant breeders developed new plant varieties, which used fertilisers more efficiently, increased pest resistance and were better suited to local growing conditions.

Two other studies, both over half-century, have provided differing estimates of yield increases[61]. Fehr estimates that yield increases in corn and sorghum from 1930-80 were 4.6 tonnes per hectare and 1.6 t/ha respectively. Thirtle finds that the yield increase in corn was a modest 1.7 per cent per year between 1939 and 1978 and those for wheat and soya beans were 1.5 and 1.1 per cent respectively. This study also found that improved varieties of seeds accounted for 50 per cent of the yield increase in corn, 85 per cent in soya beans and 75 per cent in wheat. Note, however, that these yield increases are reported in crops not included in the Plant Patents Act of 1930.

Since the Green Revolution, the so-called modern varieties of seeds have spread widely in both the developed and developing worlds. By the early 1990s, an estimated 60-70 per cent of the combined rice, maize and wheat area in developing countries was planted to these new varieties. This spread was not surprising given that almost half of the yield growth in the post-Green Revolution phase was found to have taken

[53] Developing country evidence remains unavailable since most of these countries that have IPRs extending to agriculture have done so recently.

[54] Byerlee, 1996, p 697

[55] Rangnekar, 2000

[56] Fuglie et al, 1996

[57] Includes all crops except grasses and vegetables

[58] Fuglie et al 1996, p 38

[59] Including sexually propagating plants, which were granted stronger protection by the PVPA of 1980

[60] Fuglie et al, 1996, p 38

[61] Quoted by Fuglie et al 1996, p 44

place on account of "genetic gains in yield and improvements in other varietal traits".

These advances have been achieved almost entirely through the efforts made by the International Agricultural Research Centres (IARCs) and the National Agricultural Research Systems (NARS) in various parts of the world. Notably, these important technological advances took place in the public sector where IPP played no role.

4.1.3 IPRs and concentration within the seed industry

"The success of the Act (PVPA of 1970) in creating such incentives is reflected… by the more than 50 seed company acquisitions by pharmaceutical, petrochemical and food firms..."

Leibenluft quoted in Lesser, 1998

One concern arising from strengthened IPRs is the effect on the degree of competition in the seed industry, which, in turn, determines the prices at which seeds and other planting material are available to farmers.

Lesser and Masson during the early 1980s studied the likely economic impact of the strengthened PVPA in the USA for the American Seed Trade Association (ASTA)[62]. This study indicated that the strengthened PVPA was unlikely to affect the degree of competition in the industry for two reasons. First, the US seed industry was too fragmented with the top 20 firms belonging to ASTA accounting for about 32 per cent of sales and many small seed propagators were not ASTA members[63]. Secondly, the PVPA was felt to be rather weaker than was perceived, because it allowed use of protected varieties for research and also allowed farmers to re-use farm saved seeds, which was important in major crops like wheat[64].

Evidence from the seed industry presented a different scenario[65]. Mooney identified "762 corporate 'changes' in the industry which have either taken place since the adoption of national PBR laws or, where no such laws exist, appear to have arisen since 1970", ie since the PVPA was enacted. Of these 762 firms, 529 appeared to have been acquired outright, 165 may either have been developed by the parent company or were acquired and the remaining 68 may have been controlled by larger entities or may only have had a contractual relationship[66]. No longer are there the many independent small seed businesses described by Lesser. Indeed, in 1979-80, just prior to strengthening the PVPA there were 27 mergers[67].

The 1990s have witnessed a spate of mergers and acquisitions in the global seed industry. This coincided with the sweeping changes in IPP in agriculture, via the formalisation of UPOV '91 and the TRIPS Agreement. The leading firms chose their own distinct ways of contributing to the consolidation of the global seed industry. Monsanto had made 18 acquisitions by the end of the third quarter of 1998, which it had began by taking over Dekalb in 1996[68], and had completed overseas acquisitions worth $7.3 billion in two years. Novartis was formed by the merger of Ciba Geigy and Sandoz and it bought up six French firms. DuPont entered the market in a big way through joint ventures, carrying out 20 valued at over $ 5 billion during the late 1990s. These mergers led to considerable restructuring of the seed industry world-wide (Box 9).

4.1.4 The impact on seed prices

Persuasive evidence has been presented on the relationship between the rising prices of seeds and IPP in agriculture. Price movement data from 1967-79 for seed prices of crops dominated by non-hybrid varieties enables a comparison to be made of prices before and after the enactment of PVPA[69]. Between 1970-79 prices of seeds of major crops increased nearly threefold. This increase took place after the prices of wheat and soya beans had decreased during the three years immediately before the PVPA was enacted. The price of corn seeds increased from 1967-70 but this increase was modest compared to the next three years. The increase in seed prices stands out even more when compared to price trends in other inputs. For these, the increase from 1970-79 was less than 130 per cent, while seed prices increased by over 150 per cent (Box 10).

In Argentina, farmers used more farm saved seeds as seed prices rose – even when the cost of seed saving is eroded by the deterioration of saved seed, causing yield losses. This was particularly high for hybrids, but even then, farmers used farm saved seeds instead of buying new seeds[70]. A US General Accounting Office report in 2000 showed US soya bean farmers paid more than twice as much for Roundup Ready seeds compared to Argentinean farmers. Pre-1998, a bag of this seed cost nearly the same in the two countries but subsequently, seed prices fell to about $9 a bag in Argentina, compared to $21.50 in the USA. This was primarily because 80 per cent of the soya bean seed market in Argentina was either farmer-saved or brown-bagged[71]. More recently, Canadian farmers too have "brown bagged" various commodities as the royalties charged by seed companies on protected varieties raised seed prices[72].

Available evidence clearly indicates that seed prices tend to increase as IPRs are

[62] Lesser and Masson, 1983

[63] Lesser and Masson, 1983, p 65

[64] Lesser and Masson, 1983, p 65

[65] Sehgal, 1999

[66] Mooney, 1983, p 152

[67] Butler and Marion, 1985

[68] Joly and Lemarie, 1998

[69] Lesser and Masson, 1983, p 86-87

[70] van Wijk, 1996

[71] Hillyer, 2002

[72] Ewins, 2001

9. Seed industry mergers and acquisitions

Parent company[a]	India	China	S.E. Asia	S. Africa	Brazil	Argentina
Monsanto/ Pharmacia (Holdens, DeKalb, Asgrow, Stoneville, Cargill International, Delta & Pineland[b])	MAHYCO (joint venture for cotton; 26% share of MAHYCO stock) E.I.D.Parry (maize, sorghum and sunflower with DeKalb), Cargill	CASIG (maize with DeKalb) Xinjiang and Shaanxi Provincial Seed Cos Hebei Provincial Seed Co (cotton), Cargill (Liaoning)	DeKalb (joint venture with Charoen Pakphand) Cargill	Delta & Pineland[b] Calgene Carnia (Cargill)	Agroceres Asgrow BrasKalb Monsoy Cargill	Asgrow, DeKalb, Cargill
Du Pont (Pioneer)	Joint venture with Southern Petrochemicals	Pioneer Research Subsidiary	Pioneer	Pioneer	Pioneer	Pioneer
Aventis (AgrEvo, PGS, Nunhems, Sunseeds)	Proagro joint venture with PGS, in 1998 Agrevo buys Proagro. Sunseeds	Sunseeds joint venture	Sunseeds	Aventis	Aventis Granja 4 Irmaos SA (rice)	Aventis
Syngenta - Merger of Novartis and Astra/Zeneca. (Northrup King, Rogers, HillesHog via Novartis; Advanta via Astra/Zeneca[c])	Novartis (was Sandoz) ITC/Zeneca	Advanta	Novartis		Northrup King	Northrup King
Dow (Mycogen, Cargill USA and Canada)					Dinamilho Hibridos Colorado	Morgan SA
Empresas La Moderna (Seminis, Peto, Asgrow-Vegetables)	Seminis	Petoseeds joint venture with CASIG and subsidiary in Shanghai	Petoseeds		Petoseeds	

[a]Acquisitions in parenthesis [b] Strategic alliance not ownership [c]rights to technology but not germplasm *Source*: Byerlee and Fischer, 2000

introduced in agriculture. In exercise of the monopoly afforded by IPRs, seed companies seem to develop a tendency to exploit the market by charging higher prices. The increase is sufficiently high for farmers even in industrialised countries to resort to using farm saved seeds.

Recent studies on the possible economic impact of the introduction of PBRs have been less conclusive about the benefits that have accrued. Jaffe and van Wijk examined the impact of PBRs on R&D expenditures in Argentina by surveying a number of firms engaged in plant breeding. The R&D investments of these firms had indeed increased between 1986 and 1992. However, the incentives for these increases, according to the authors, were more the changing economic policies and liberalisation, rather than the introduction of PBRs.

Venner's study on the nature of wheat breeding in the USA using data up to 1994, more than two decades after the PVPA was adopted, showed that while public expenditure had doubled in real terms, private expenditure had remained almost static. Thus, protection for self-pollinating crops, which was what the PVPA had aimed at, did not stimulate private sector R&D activity, at least in wheat breeding.

4.2 Impact on biodiversity

A major environmental issue is whether or not IPRs lead to the spread of monoculture and loss of biodiversity. Walter Reid found a strong connection between IPRs and a bias towards centralised research, which itself has an adverse impact on biodiversity. Centralised research, he argues, "discourages agro ecological research of local breeding tailored to local conditions" [73]. Seed companies tend to focus their research on commonly used high value crops and develop varieties that can be grown as widely as possible – as is shown by the concentration of varietal development in a few crops in the USA.

The expansion of the IPR regime in agriculture tends to create a market for seeds and other planting material that is dominated by a few large companies. Such a "monopoly rights system encourages and seeks to solidify an agricultural system that is environmentally damaging and incompatible with the concepts of sustainable development" argues Klaus Bosselmann[74]. Plant breeders contest the view that modern plant breeding results in loss of biodiversity. This criticism, in their view, "is most often poorly or not at all substantiated or based on wrong concepts"[75]. This

[73]Quoted by Dutfield, 2000

[74]Bosselmann, 1995

[75]Le Buanec, 1999, p 1

10. Prices paid by US farmers for major crop seeds and other products, 1967-79 (1967=100)

Year	Corn	Soya beans	Wheat	Feed	Fertiliser	Agri-chemicals	Fuel & energy	Other products
1967	100	100	100	100	100	100	100	100
1968	108	92	90	94	94	101	101	100
1969	106	95	87	96	87	100	102	104
1970	122	92	90	101	88	98	104	108
1971	146	111	94	105	91	100	107	113
1972	167	118	103	106	94	103	108	121
1973	172	199	190	160	102	105	116	146
1974	194	216	291	194	167	119	159	166
1975	283	239	253	187	217	160	177	182
1976	283	168	229	191	185	174	187	193
1977	310	295	176	186	181	157	202	200
1978	333	261	201	183	180	147	212	217
1979	353	273	234	204	196	150	276	248

Source: Lesser and Masson, 1983. The figures are calculated using 1967 prices as the base

particular debate, however, is still in its infancy with the biodiversity-rich developing countries still preparing to introduce IPRs in agriculture.

The available evidence on the impact of PVP in countries with some experience of this suggests that the relationship between the adoption of this system and the benefits flowing from it has not been very obvious. Most studies do not show that providing protection to plant breeders has led to a definite improvement in R&D by private breeders. This is significant since one of the strongest justifications for introducing PVP has been that this, like other forms of IPRs, would provide incentives to the rights holders to deliver improved varieties.

Recently, some developing countries have expected the private sector to stimulate plant breeding activities which previously were almost entirely government-supported. As fiscal crises in many developing countries have deepened, the flows of public funds into agricultural research have decreased alarmingly. Many have, therefore, encouraged the private sector to compensate for the decrease in public spending by introducing PBRs. The evidence from the above studies does not seem to support this confidence.

Another issue is that the cost of seeds could be affected after PBRs are introduced. Some of the recent debate on genetically-engineered seeds has seen strong support expressed for the gene technology on the grounds that substantial yield increases can be obtained[76]. This ignores the increased cost of seeds produced using biotechnology and implies that the high yields promised by these seeds would be incentive enough for the farmers to sow them. This assumes first, that all farmers can pay for higher priced seed and, secondly, that farmers would spend more on seed since they would be generating more revenue from the increased output.

Both these assumptions are not valid for the large majority of farmers in many developing countries who often need inputs at subsidised prices. Many farmers also find it difficult to market their produce at remunerative prices since they have virtually no say in the market place. Governments seek to ameliorate this situation by farm support measures. However, such spending has now come under the WTO discipline through the Agreement on Agriculture (AoA) and faces an uncertain future.

The AoA has put a ceiling on developing countries' ability to subsidise farm inputs, which would constrict the capacity of farmers to use the new seed varieties. Higher prices for seeds, which could result from the introduction of PBRs in developing countries, would set limits on the ability of the farmers to use them.

"the legal requirements of PBR encourages phenotypic uniformity which increases crop vulnerability and eliminates varieties...[and the]...eliminated varieties are often lost to humanity"

Mooney, 1980, p69

"a scientific analysis [of long period data from India, France and the UK] shows that it is not possible to say that crop genetic diversity is decreasing due to modern plant breeding and the growing of modern varieties"

Le Buanec, 1999, p 6

[76]Ghosh, 2001

5. Conclusion

Enactment of "effective" *sui generis* legislation for PVP in line with their commitments under Article 27.3 (b) of the TRIPS Agreement is a contentious issue in several developing countries. This Article extends IPRs to developing country agriculture and brings their regimes of IPP in line with those in developed countries. There is, however, an important difference between the two sets of countries in the process of extending PVP. While the latter evolved the system of protection after decades of debate involving local stakeholders, the former have to do so without any such process and within the relatively short time frame provided for in the TRIPS Agreement.

The Agreement does not define what constitutes an "effective" *sui generis* system. This offers the flexibility to WTO Members to devise PVP systems which suit their interests to the fullest extent.

The *sui generis* legislation that developing countries must introduce has to take into consideration the interests of both the farming communities and the plant breeders in the formal sector. Agriculture in most developing countries relies significantly on the traditional farming communities who have made their contribution to production through informal innovations. Most importantly, the seed supply systems in many countries continues to be in the hands of the farming communities, despite plant breeders in the formal sector starting to make inroads here.

Countries in the process of enacting legislation need to take this reality into consideration. There needs to be a balanced approach towards protecting the interests of the plant breeders in the formal sector and the traditional farming communities. This is particularly important given the evidence available from countries that have shifted the balance almost totally in favour of the former interest group. The introduction of PBRs has not spurred R&D activities as expected, which has been the main objective of providing legal protection to the breeders. Moreover, prices of seeds and other planting material have moved adversely for the users.

These experiences have provided the basis for discussions in the developing world about evolving various forms of *sui generis* PVP legislation that could provide a more balanced approach. India has taken a significant step in this direction by enacting legislation that explicitly provides for farmers' rights in addition to PBRs. Namibia has taken a similar step by debating legislation that provides rights to traditional communities on the genetic resources they have been using as well as rights to farmers and plant breeders. These legislative initiatives provide a useful starting point for introducing plant variety protection in developing countries.

The donor community could play a crucial role in this process (Box 11).

11. Issues for Official Development Assistance

"We underscore the urgent necessity for the effective coordinated delivery of technical assistance with bilateral donors, in the OECD Development Assistance Committee and relevant international and regional intergovernmental institutions, within a coherent policy framework and timetable".

Ministerial Declaration, WTO Ministerial Conference, Fourth Session, Doha, 9 - 14 November 2001

The Ministerial Declaration on the TRIPS Agreement and Public Health proposes a balanced approach towards protection of IPRs, one that takes into consideration the public interest. This process of reassessing the IPP system initiated at Doha in 2001 should be taken forward by including areas that are of critical importance for protecting livelihoods, particularly those of the relatively disadvantaged sections in the developing countries. Extending IPP to agriculture in the developing world could raise a number of such issues, which would need close consideration by the global community.

Donors could consider:

1. Supporting the processes currently underway in several developing countries towards developing *sui generis* legislation for PVP.
2. Developing institutions/instruments in countries that have enacted legislation for PVP to ensure that the marginalised sections of the farming community do not face adverse impacts.
3. Creating capacities within developing countries so that they can engage effectively in the on-going negotiations in various international fora on IPP by:
   i) Building networks between civil society organisations, including farmers' organisations, for assessing the impact of IPP in agriculture on farming communities, biodiversity and the overall food system.
   ii) Establishing linkages between civil society organisations, government agencies and private sector seed companies to build mutually supportive systems.
4. Helping establish seed systems in developing countries that can respond to the needs of the poorer sections of the farming community.

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Acronyms

AIPPI	International Association for the Protection of Industrial Property
AoA	Agreement on Agriculture
ASSINSEL	Association of Plant Breeders for the Protection of Plant Varieties
ASTA	American Seed Trade Association
CBD	Convention on Biological Diversity
CoFAB	The Convention of Farmers and Breeders
DUS	Distinctiveness, Uniformity and Stability
EDV	Essentially Derived Variety
FAO	Food and Agriculture Organisation of the United Nations
FRs	Farmers' Rights
FTAA	Free Trade Area of the Americas
GATT	General Agreement on Tariffs and Trade
IARC	International Agricultural Research Centre
IPP	Intellectual Property Protection
IPRs	Intellectual Property Rights
ITPGR	International Treaty on Plant Genetic Resources for Food and Agriculture
NARS	National Agricultural Research System
NGO	Non-Governmental Organisation
ODA	Official Development Assistance
OAU	Organisation of African Unity
PBRs	Plant Breeders' Rights
PPVFR	Protection of Plant Varieties and Farmers' Rights Act
PTD	Participatory Technology Development
PVP	Plant Variety Protection
PVPA	Plant Variety Protection Act
RPF	Resource Poor Farmer
TRIPS	Trade-Related Aspects of Intellectual Property Rights
UPOV	Union Internationale pour la Protection des Obtentions Végétale [International Union for the Protection of New Varieties of Plants]
WIPO	World Intellectual Property Organisation
WTO	World Trade Organisation

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