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IMPLEMENTATION OF PLANT VARIETY PROTECTION

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1. Introduction

The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs) was signed by 125 countries in 1994 as part of the new General Agreement on Tariffs and Trade (GATT) and established minimum standards for intellectual property rights (IPR). The TRIPS Agreement requires in Article 27(3)b that the members of the World Trade Organization (WTO) - the succeeding organisation of GATT - to provide protection for plant varieties by "patent or an effective *sui generis* (= of its own class) system, or a combination thereof ".

All WTO members (146 as of April 2003) are obliged to implement the provisions of the TRIPs Agreement. The least developed countries (LDC's) have until January 1, 2006, to comply, with the possibility of an extension. As a consequence, many countries have ventured into the development of a legal basis for the protection of plant varieties, linking up with other international agreements regulating access to genetic resources and the sharing of benefits.

However, most international discussions on these topics concentrate on the legal issues and not so much on taking into consideration that the introduction of a sound Plant Variety Protection (PVP) system has consequences of an institutional, technical, financial and commercial nature. In the present paper some of these issues are discussed, the coherence of plant variety protection with the other steps in the so - called "Plant Variety Chain" is elaborated and the effect of PVP on the seed industry is presented. The PVP system referred to in this presentation is the UPOV (International Union for the Protection of New Varieties of Plants) *sui generis* PVP system.

2. The development of the "Plant Variety Chain"

Many developing countries have an agricultural economy that is mainly geared to domestic markets and that depends largely on farmer-produced seed[1] of both "traditional" and "improved" varieties that are maintained and further adapted to the local conditions by small-scale farmers. These so - called farmer seed systems broadly refer to the processes which farmers use to produce, obtain, maintain, develop and distribute seed resources from one growing season to the next and from one farmer to the other. Every year, plants with high yields, good quality and high adaptability are selected consciously or unintentionally resulting in a gradual and slow improvement of variety performance over time. Many countries have promoted this farmer-to-farmer exchange of new varieties through what became known as 'lateral spread' in order to rapidly disseminate new varieties.

2.1 From a farmer seed system to a formal seed system

With the introduction of a PVP system, the farmer seed system will transform into a formal seed system. Even more so since the 1991 Act of the UPOV Convention restricts the rights of farmers to save and exchange seed of protected varieties between each other and gives breeders greater control over the use of their varieties. However, under the UPOV Convention, countries may allow in their legislation certain categories of farmers to produce seed for certain crops for their own use, as long as the legitimate interests of the breeder are taken into account. The evolution from a farmer seed system to a formal seed system could follow the subsequent steps as shown below.

[1] In the context of this paper "seed" refers to both generatively and vegetatively plant material.

Stage 1 – Public and farmer breeding, small scale seed distribution
At this stage, plant breeding is often undertaken and financed by government agencies (public breeding) as part of their policy to secure an adequate supply of food, feed and industrial needs. Seed of the resulting varieties will then be made available to a few (selected) farmers and seeds may be redistributed to neighbouring farmers. Farmers may also undertake breeding and distribute seed on a small scale.

Stage 2 – Seed production
If a breeding program delivers high performing varieties, an increasing demand for seed of these varieties will soon develop and an ample supply of seed has to be secured. Large scale seed multiplications by selected seed growers have to be set up and seed technology has to be developed (growing and harvesting techniques, seed processing, seed storage, packaging etc).

Stage 3 - Quality control of seed produced
Once large scale seed production has been materialised, the need arises to have a good quality control system on the seed produced to guarantee that the seed the farmer buys is of high quality (germination, purity, free of weeds). Seed certification and marketing will develop.

Stage 4 - Variety consciousness and market regulation
The demand for better varieties will develop and farmers will become aware of the genetic quality of a variety. Variety research is then required to asses the identity of the variety for certification according to the principles of D (distinctness), U (uniformity) and S (stability) and to asses the performance of the variety for marketing purposes (VCU test – Value for Cultivation or Use). These measures will lead to a regulation of the marketing of the developed varieties.

Stage 5 - Legal framework for plant breeders' rights and development of private breeding
Plant breeding is a long - term investment of 10 - 15 years. In order to recapture these costs, a legal framework for intellectual property rights on plant varieties has to be built up to provide the breeder of a new variety the exclusive rights to exploit that variety. Through an effective plant variety protection system the breeder will be able to recover his investments.

Once the preceding stages have been fully implemented, the “Plant Variety Chain” (see Figure 1) then comes into full operation.

2.2 “Plant Variety Chain”

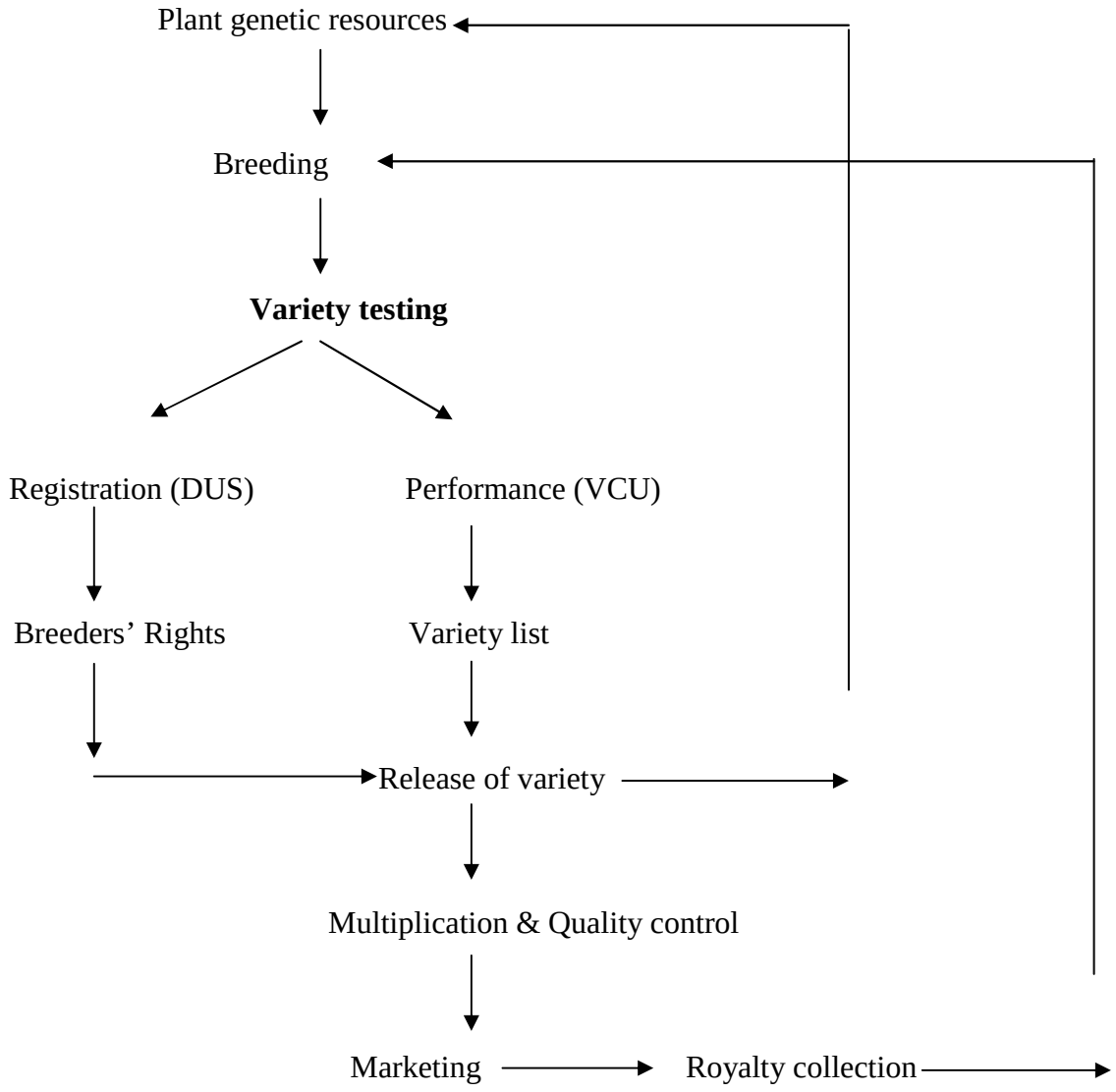
The “Plant Variety Chain” covers all the steps from plant genetic resources to the end product. Beginning with promising genetic resources, the breeder develops the new variety by either using this germplasm directly or by incorporating it into existing varieties. The varieties developed have to be tested for DUS, whereby the breeder can request Plant Variety Protection. For agricultural and vegetable crops performance may be tested by the breeder or by breeder plus authorities to assess if the new variety is an improvement in relation to existing varieties (VCU test). If the variety is promising, an adequate seed supply has to be built up under the control of a certification authority, in order to make sure that the end-user will receive good quality seed that is true-to-variety when compared to the originally tested variety. Once the variety is brought on the market, a royalty collection scheme should be in operation to ensure the breeder a return on his investment and to finance further breeding. At

the same time the developed variety will enter the genepool for usage world wide (breeders' exemption).

Protecting varieties that do not have a good agricultural value does not make sense. The farmer or the grower has to be certain that purchased seed of the protected variety is of good quality and true-to-variety. Adequate supply of the improved and protected varieties must be available in order to give the farmers the opportunity to purchase these varieties. The breeder must be confident that his Plant Breeders Rights will be respected and that a royalty collection scheme is in operation. And finally the farmers or growers should be convinced that the purchase of certified seed provides enhanced variety performance, resulting in better higher financial returns or possibly some other desired objectives.

Plant variety protection will play an important role in improving agricultural and horticultural output, benefiting the breeder, the farmer and the end-user of the produced product, and national food security.

Figure 1 "Plant Variety Chain"



Two important aspects come to the foreground in the “Plant Variety Chain” of Figure 1:

- The royalties collected are poured back into the breeding program for further financing the development of new varieties;

- The improved varieties are incorporated into the gene pool for further breeding (an essential provision provided under the UPOV Convention, the so called “breeders' exemption” from which new varieties can be “built on”.

However, good governance in a particular country is essential for a proper enforcement of all aspects of the Plant Variety Chain.

2.3 Examples of the development of a formal seed system

In the Table 1 the development according to the different stages as outlined in 2.1. is presented for Kenya and the Netherlands.

Table 1 The evolution from a farmer seed system to a formal seed system in Kenya and the Netherlands

#	Stage	Kenya	The Netherlands
1	Public and farmer breeding and small scale seed distribution	1956 - Farmers start Kenya Seed Company: seed production of grasses and legumes (ecotypes identified by government stations), production of sunflower seed (1958)	1900 - 1943 Governmental and private breeding 1934 - 1942 Breeders Compensation Fund (levy scheme on certified seed)
2	Seed production	1963 - Seed production of hybrid maize, varieties developed by government station Seed production by selected farmers	1900 Seed certification
3	Quality control of seed produced	1960 – Quality control in cereals and grasses (Scott Agricultural Laboratories) 1970 - Inception of a comprehensive quality control service 1981 - Seed health	1932 – Establishment of General Inspection Service Agricultural Seeds and Seed Potatoes (NAK) 1941 – Establishment of General Netherlands Inspection Service for Vegetable and Flower Seeds (NAKG)
4	Variety consciousness and market regulation	1976 - Variety research : DUS, VCU	Since 1880 – Simple performance testing 1914 – Regulation on variety testing for novelty, uniformity and performance 1924 – First Recommended Variety List of Agricultural Crops
5	Legal framework for plant breeders' rights and development of private breeding	Private breeding develops since 1990 1999 - Accession to UPOV 1978 Act Present: Implementing PVP system	1942 - 1967 – Kwekersbesluit (1967 – present – Seeds and Plant Materials Act 1968 – Accession to UPOV 1961/1972 Act 1998 - Accession to UPOV 1991 Act PVP scheme in full operation

From the presented table it is clear that, in the Netherlands, the development of a formal seed system as stretched over a long period, while the PVP development in Kenya is of a recent date. Both countries are UPOV members, the Netherlands having completed stage 5 while Kenya recently entered stage 5.

New UPOV member states or future members are in different stages of development towards a formal seed system. The evolution towards a formal seed system as outlined in section 2.1 is a logical one. The introduction of a legal framework for plant variety protection is often an effective stimulus to develop the other stages in this process and to strengthen the various links in the "Plant Variety Chain." And countries being or becoming members of UPOV will be a great help to develop these different steps as will be outlined below.

A special note should be made on ornamental, vegetatively propagated crops, not being a first necessity of life but being an important crop to earn foreign currency in many developing countries. With a sound PVP system in operation, foreign breeders will send their most valuable new varieties to that particular country for flower production for export, making it possible to control illegal reproduction of the protected variety. When the importing country has a protection system for such varieties it may block the product from entering the country when the breeder has not given permission to multiply the crop in the exporting country. Countries where their interests are not secured, tend to loose potential export income when an acceptable level of protection cannot be granted. Such opportunity costs may negatively affect employment and tax-income. For the development of this sector the outlined evolution does not apply and the different steps are bypassed.

3. Institutional arrangements for a plant variety protection system

The strength of the UPOV *sui generis* PVP system is that a ready–made system is provided, developed over three decades of experience (primarily in Western States) . The greatest asset of the UPOV system is its harmonisation of a PVP system between 53 members, in particular its technical implication for testing distinctness, uniformity and stability. All member states have the possibility to participate actively in the further development of UPOV on all juridical and technical aspects through the various Technical Working Parties and Committees. In this world forum, new and future members can thus benefit from experiences of older members, especially as many countries cannot afford the time to go through the long time evolution from a farmer to a formal seed system as happened in the Netherlands within the few years that they are given to comply with TRIPs.

Implementing a PVP system requires an institutional organisation that

- deals with all procedural aspects regarding the application for and granting of Plant Variety Protection;

- provides technical information on the applied variety on which the authority can base its decisions.

3.1. National authority on PVP

Similar to most intellectual property rights regimes, an application has to be examined before the protection of a plant variety can be granted. This requires a national authority on PVP that can decide on applications and grants for plant variety protection, proposals for variety denominations, variety descriptions, requests for compulsory licences, requests for annulment of a plant variety protection and claims for the property of a PVP by another party.

Such a PVP authority can consist of two departments: one taking the decisions (the actual board) and one carrying out the administrative work (secretariat). Another option is that one PVP Office runs the administration and makes the decisions.

3.2. Technical examination

The national authority bases its decision on a technical examination that is carried out in the field and/or the greenhouse, whereby the variety has to comply with the requirements for DUS according to the standardised UPOV guidelines. A technical examination on a new plant variety is comparative research: the new variety is compared with already existing varieties from which the new variety has to distinguish itself in one or more characteristics, next to being uniform and stable.

The technical examination can be carried out according to different options (Article 12 of the 1991 UPOV Act) as presented below.

Official examination
In many European countries centralised, official testing systems on behalf of the PVP authorities have been developed. The applicant provides the national authority through a technical questionnaire information on the variety such as species, origin, method of breeding, technical characteristics and other information helpful for the technical examination and provides a seed sample or plant material of the variety. The national authority carries out (or let it carry out) a DUS test incorporating all filed applications and necessary reference varieties.

Breeder testing
The main alternative strategy for the official DUS-testing is to make the breeders themselves primarily responsible for the information on which a decision can be based. Breeders then have to prepare full DUS-reports (according to the UPOV guidelines) to the PVP Office, based on their own trials.

Various types of breeder-testing for DUS are operational in different countries with various levels of involvement of the official authority.

Collaboration among UPOV members
As mentioned before, through UPOV a very high degree of harmonisation in the technical examination has been achieved, which allows for international co-operation in different forms.

- Bilateral co-operation is the most common form, whereby a national PVP Office may request a DUS-testing facility of another country to carry out the technical examination on a certain variety under a formal agreement between the two States. Reasons for such a request can be that the requesting State has no infrastructure for carrying out the test or that the examining country has wide expertise for that special crop or for reasons of efficiency. The Netherlands, for example, is carrying out the DUS test for a certain grass species for France, Germany and the UK, making the testing more cost - efficient for all parties concerned.

It also can happen that a PVP Office purchases the DUS report from another country when the filed variety has already passed (or is in the process of passing) the technical examination in the latter country. UPOV members have agreed on fixed fees for taking - over DUS reports. For example, Kenya is purchasing on a regular basis DUS reports on ornamental crops, roses in particular, and granting PVP in Kenya on the basis of the Dutch DUS examination.

- Regional co - operation can be found in the European Union. The Community Plant Variety Rights System offers protection in all EU countries through one single application and based on one technical examination. For certain genera and species of ornamental crops DUS – testing has been centralised in one of the EU Member States, while the testing of the same species in different countries occurs as well. Clearly defined protocols, based on the UPOV guidelines, are a requisite for the smooth running of such a system. A quality management system for variety testing further guarantees a strict compliance with the defined protocols and as a consequence, quality of DUS testing.

The various options show a varying degree of official involvement and costs. UPOV members are allowed the flexibility to choose the system that suits them most, depending on general policies dealing with the role of the State and capacities in terms of expertise and infrastructure. It should be highlighted however, that an emerging PVP system can rely heavily on the information and data available from experienced UPOV members: the building up of its own, completely independent system is not necessarily required when introducing PVP in a country. The possibilities of bi-lateral and/or regional collaboration should be explored first.

4. Effect of PVP on the seed industry

In the following paragraphs some effects of PVP on the seed industry are given.

- *Promotion of breeding*

Increased investments in breeding efforts have generally been seen in countries that have introduced PVP in the last few decades (Lesser, 1997; Eaton, 2002). The US PVP Act of 1970 is associated in a number of studies with higher investments by public and private sector breeders for a number of crops (Butler and Marion, 1985; Perrin et al, 1983; Alston and Venner, 2002). A recent review of the Canadian Plant Breeders' Rights legislation of 1990 indicated increased research and development investments particularly in some oilseeds and pulses (Canadian Food Inspection Agency, 2001). Similar results have also been found in Spain which introduced its first national plant variety protection in 1975 (Diez, 2002). A study of seed breeding companies in Argentina also found a tendency for research investments to rise with the adoption of plant variety protection (Jaffe and Van Wijk, 1995).

Furthermore, research is indicating that the strength of protection offered under PVP may be a key factor in determining its effectiveness as an investment stimulus. This provides further evidence of the potential incentive for R&D that PVP creates. Data for 13 OECD (Organisation for Economic Co-operation and Development) countries covering agricultural R & D expenditures in the 1990s shows a significant link between these expenditures and both the extent of IPR protection available and the number of new varieties granted protection (Srinivasan et al, 2002). The investment patterns observed across crops with different degrees of biological “protection” also support the view that protection possibilities, including IPR, stimulate investment in breeding of improved crop varieties.

In most cases, it is also possible to attribute these favourable investment trends to a variety of economic developments, such as market liberalisation, increasing demand for specific crops or improved access to foreign markets. This makes it difficult to demonstrate the specific effect due to plant variety protection, particularly given the long timeframes involved. It seems likely that some form of intellectual property rights on plant varieties is necessary to

ensure that incentive exists for breeders to invest in developing new varieties. But it should probably not be expected that this alone would boost private sector breeding investments; other economic factors play an equally important role.

The Netherlands has a long history in breeding and variety protection as shown in Table 1. The legal and technical conditions for breeding have already been created at the beginning of the last century, stimulating the development of an active breeding industry, resulting in many varieties of agricultural and horticultural crops. This is not only apparent from the large number of protected varieties in the Netherlands, but also comes to the foreground in the number of applications for European Plant Breeders' Rights in comparison with other Member States of the European Union (EU) (see Table 2).

Table 2 Number of applications received by the Community Plant Variety Office for Community Plant Variety Rights (April 1995 – July 2003)

Applications received from	*Number*	**Percentage of total applications**
Netherlands	6322	35.9
Germany	2753	15.6
France	2455	14.0
Denmark	1016	5.8
United Kingdom	947	5.4
Other EU countries (10)	1317	7.5
Total EU countries	14810	84.2
Non – EU countries (12)	2780	15.8
Total	17590	

- *Introducing foreign varieties*

Where an intellectual property rights system may stimulate breeding, the absence of such a system in a country is likely to deter foreign breeders from introducing their varieties in that particular country. Only if an effective plant variety protection system is in operation, breeders from abroad will be able to protect their long-term investments. The recipient country then benefits through access to varieties with superior characteristics that boost agriculture, benefiting farmers, growers and consumers. The introduced varieties can also be used as good sources of germplasm for local breeders to use in their own breeding programs and therefore to advance local breeding.

The effects of introducing a PVP system can be seen in Canada. The effects of the adoption of the Canadian Plant Breeders' Rights Act of 1990 are most visible in the number of foreign varieties registered for protection in the following ten years. These were most pronounced in value-added sectors of horticulture, such as ornamentals in which 97% of protection certificates granted during the 1990s were of foreign origin (Canadian Food Inspection Agency, 2001). Many horticultural crops tend to be cultivated intensively under more controlled conditions than open-field agricultural cereal, pulse or oilseed crops. Adaptive breeding of the latter to match local agro-climatic circumstances is thus more often required while foreign varieties of horticultural crops can often be productively cultivated as they are.

Data from 30 UPOV members for six primarily agricultural crops highlights these differences (Srinivasan et al, 2002).[2] 46% of all potato varieties granted a PVP certificate are protected in more than one country, while for wheat and maize, this percentage is 18% and 13% respectively. This data reveals a significant relationship between IPR protection and the marketing of foreign varieties.[3]

- *Production for export*

An important consequence of having an effective PVP system in place is the production for export. Such export products that meet the needs of the foreign markets, are often based on foreign breeding. This is particularly the case in ornamental plants as already mentioned in Section 2.3.

When accompanied by trade liberalisation, the effect of PVP on access to foreign varieties for export production may be even more pronounced. For example, Canada's introduction of PVP in 1990 was also timed with the Free Trade Agreement with the United States of America. For developing countries, the introduction of PVP, as required under the TRIPS Agreement, will often coincide with increasing trade liberalisation also within the framework of the WTO. Increased access to foreign varieties could thus be expected to benefit particularly countries with relatively competitive export opportunities.

- *Making new varieties public*

A consequence of an IPR system is that the protected invention is likely to be made public. In the case of protected plant varieties this will be done through bringing to market seed or vegetative planting material. Protection of the variety will ultimately lead to the multiplication and exploitation of the variety to enable the rightholder to recover his investment. PVP stimulates the multiplication of a new variety where the seed producer has an exclusive license for a particular seed market, where such producers may not venture into such variety or crop if all competitors have access to the same variety. Plant variety protection thus stimulates access to the new, improved varieties for use and further breeding.

Conclusion

Depending on the stage in which a country is in its development from a farmer seed system to a formal seed system, plant variety protection is an important aspect in the total "Plant Variety Chain" from germplasm to a finished variety. While the development in many Western countries took 30 – 40 years, new and future UPOV members are given less time to comply with the TRIPS Agreement. However, implementing the UPOV *sui generis* PVP system is greatly facilitated by the harmonisation of the UPOV system between members: emerging PVP systems can build on experience from older members and can make use of the information available. Bi-lateral and/or regional collaboration will facilitate the capacity building of human and technical resources and the making of institutional arrangements. UPOV has initiated such initiatives, for example in South – East Asia.

The effect of PVP on seed industry development is especially measurable in countries with a long time experience with PVP. Access to foreign varieties is the first visible result of introducing a PVP system.

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[2] Wheat, maize, soybeans, potatoes, ryegrass and oilseed rape.

[3] For these six crops, the associated increase in access to foreign varieties is less important than the effect on domestic innovation.

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