

Session 3

PLANT VARIETY PROTECTION

Chairperson: Mr. DOUG WATERHOUSE (AUSTRALIA),
International Union for the Protection of New Varieties of Plants (UPOV)

▶ **Benefits of plant variety protection**

Mr. ROLF JÖRDENS, Vice Secretary General, UPOV

▶ **Key requirements for an effective system of plant variety protection**

Mr. PETER BUTTON, Technical Director, UPOV

▶ **Experiences in Kenya**

Mr. EVANS SIKINYI, Head, Seed Certification and Plant Variety Protection,
Kenya Plant Health Inspectorate Service (KEPHIS)

▶ **Experiences in the Republic of Korea**

Mr. CHANG HYUN KIM, Director General, Korea Seed & Variety Service
(KSVS)

General discussion

Conclusion, presented by the Chairperson

BENEFITS OF PLANT VARIETY PROTECTION

Mr. ROLF JÖRDENS*

Introduction

With regard to “responding to the challenges of a changing world”, it can be said that this is the *raison d’être* of plant breeding. The role of plant breeders is to use germplasm resources to develop new varieties which respond to particular environments and which meet consumer demand. The breeding process must meet the demands of a changing environment (e.g. evolution of disease resistance, development of varieties that perform well in different agroclimatic environments), while responding to evolving consumer demand. For plant breeders, the world is constantly changing. The role of plant variety protection in responding to the challenges of a changing world is to provide a legal framework that encourages plant breeding. The focus of this presentation is to show how an effective system of plant variety protection and UPOV membership has responded to the various demands of a range of countries.

With regard to intellectual property (IP) protection, Article 27.3(b) of the TRIPS Agreement establishes that members of the World Trade Organization may exclude from patentability plants and animals other than microorganisms; however, they must provide for the protection of plant varieties, either by patents or by an effective *sui generis* system or by any combination thereof.

With regard to patents for plants, the results of a WIPO-UPOV Symposium on intellectual property rights (IPRs) in plant biotechnology, held on October 24, 2003, in Geneva, were clear: progress in plant biotechnology is important for all countries, developed and developing, and requires appropriate protection of IPRs. In this regard, patents and plant breeders’ rights are both needed and often combined in protection and promotion of plant biotechnology. However, this paper will focus on plant variety protection.

Plant breeding requires considerable investment in time and resources. However, it can be relatively quick and easy to reproduce new varieties. Without the ability to cover their investment, breeders will be unable to invest in breeding. By making the reproduction and commercial exploitation of varieties subject to the breeder’s authorization, the UPOV system of plant variety protection provides the breeder with the possibility to recover investment in plant breeding work.

Many countries, including developing countries and countries in transition to a market economy, are considering the introduction of a system for the protection of new varieties of plants (PVP system). Most countries which have already introduced a PVP system have chosen to base their system on the International Convention for the Protection of New Varieties of Plants (UPOV Convention) in order to provide an effective, internationally recognized system (see Annex).

With respect to the purpose of a PVP system, UPOV clarifies that its mission is “To provide and promote an effective system of plant variety protection, with the aim of encouraging the development of new varieties of plants, for the benefit of society”. Thus, the UPOV system of PVP is designed to encourage innovation in the field of plant breeding, in order to promote the development of new varieties that will benefit society. Society in this context means all society, and all members of society are consumers in some way. However, it is also recognized that farmers and growers are the deliverers of the benefits of new varieties to society and are also the first beneficiaries of new varieties which offer improved income through improved yields, improved quality and the opening-up of new market possibilities.

* Vice Secretary General, UPOV

As a means of providing countries considering the introduction of a PVP system with information on the benefits they might expect, in 2005, UPOV published the "UPOV Report on the Impact of Plant Variety Protection" ("Impact Study") (<http://www.upov.int/en/publications/impact.html>). That report was based on the work of a UPOV Ad hoc Working Group to Study the Impact of Plant Variety Protection, which included members from all the countries forming the basis of the Impact Study: Argentina, China, Kenya, Poland and the Republic of Korea (see Section III of the Report "Reports on Studies Conducted in Individual Countries"). The basis of the Impact Study and some of the key findings are summarized in the following section. The findings of the studies in Kenya and the Republic of Korea are reported in separate papers.

UPOV Report on the Impact of Plant Variety Protection ("Impact Study")

In relation to the impact which might be expected from an effective PVP system, it is considered important to recognize that the positive effects of a PVP system may be realized in the form of an incentive to stimulate new breeders and new breeding work and/or providing a basis for more effective breeding work at the domestic level. These positive effects could relate equally to the private breeding sector, the public breeding sector or to partnerships between the two. However, whilst recognizing that such an impact is of critical importance, it is also recognized that an effective PVP system can also provide important benefits in an international context by removing barriers to trade in varieties, thereby increasing domestic and international market scope. In short, breeders are unlikely to release valuable varieties into a country without adequate protection. With access to such valuable foreign-bred varieties, domestic growers and producers have more scope to improve their production and also have more scope to export their products. It is also recalled that, as a consequence of the breeder's exemption in the UPOV Convention, domestic breeders also gain access to valuable varieties for use in their breeding programs. This international aspect is an important means of technology transfer and effective utilization of genetic resources. Therefore, the Impact Study considered the development of the UPOV system at the international level as well as at individual, country level.

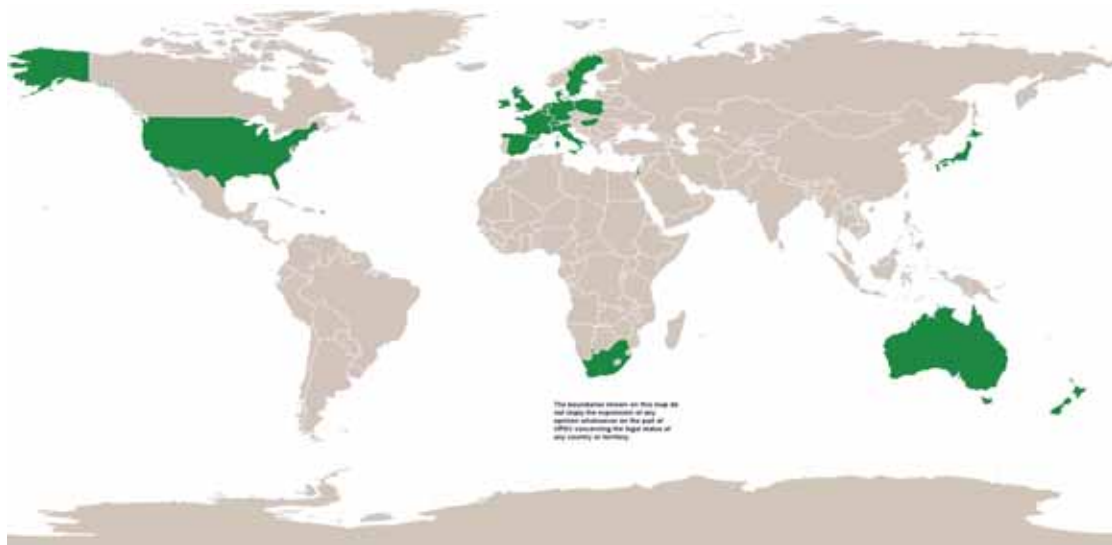
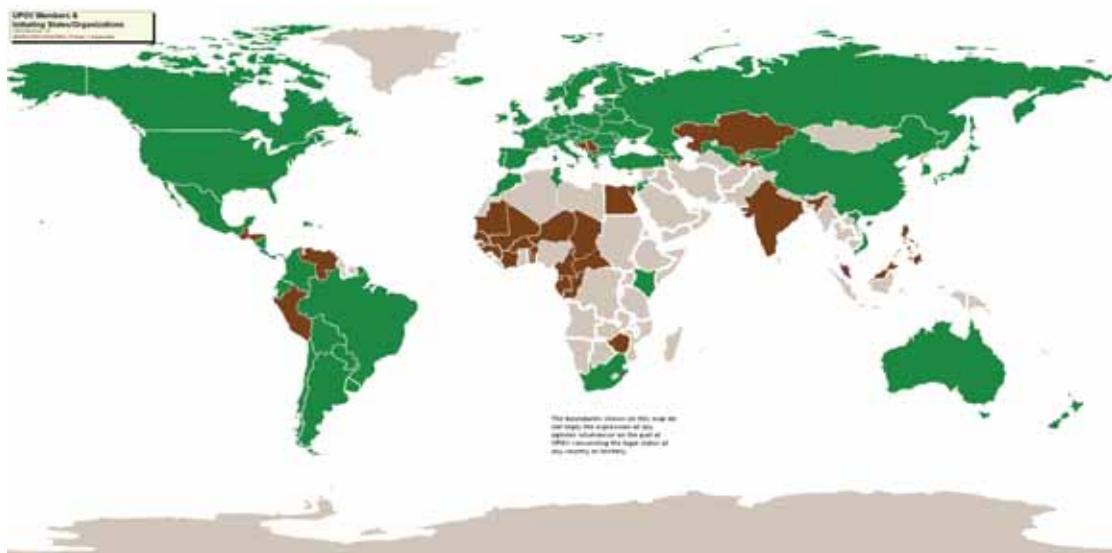
This paper revisits two of the main sections of the Impact Study: Development of the UPOV System of Plant Variety Protection and the "Reports on Studies Conducted in Individual Countries" with updated information.

Development of the UPOV System of Plant Variety Protection

UPOV Membership

The UPOV Convention was adopted in 1961 as a result of the Diplomatic Conferences held in Paris in 1957 and 1961. The UPOV Convention entered into force in 1968 with the ratification of Germany, the Netherlands and the United Kingdom. The UPOV Convention was amended in 1972, 1978 and 1991. As of September 8, 2009, UPOV had 67 members of which 43 were bound by the 1991 Act of the Convention. UPOV, which continues to be the only internationally harmonized, effective sui generis system of plant variety protection, is continuing to expand. As of September 8, 2009, 17 States (initiating States) and one international organization (initiating organization) had initiated with the Council of UPOV the procedure for becoming UPOV members (see Annex) and another 45 States had been in contact with the Office of the Union for assistance in the development of legislation on plant variety protection.

Fig. 1 illustrates how UPOV has expanded since 1990 to cover most important agricultural producers and many countries from the developing world.

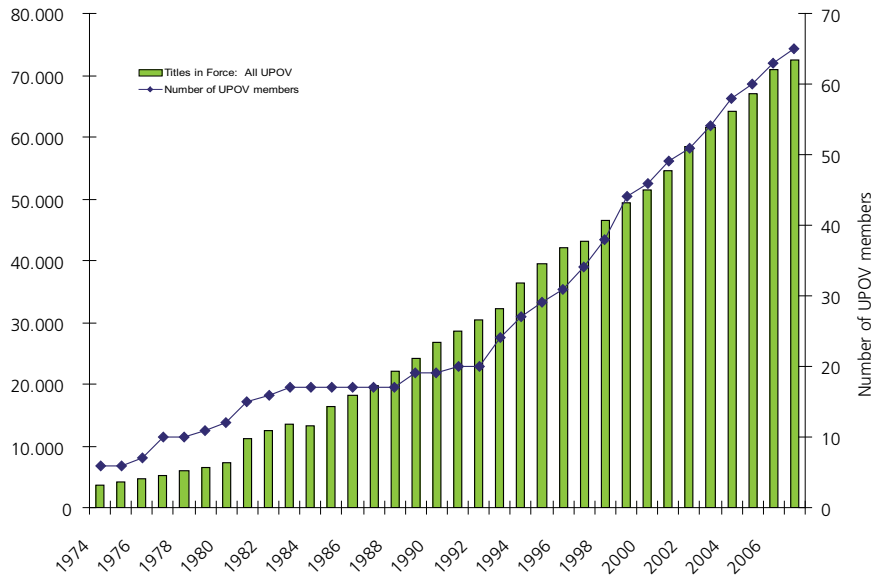
Fig. 1 Members of UPOV (shown in green): 1990**Members of UPOV (shown in dark green) and initiating States and organizations (shown in brown): September 2009**

The key to an effective PVP system is to provide incentives to breeders to develop new varieties and to avoid the absence of suitable protection being a barrier to the availability of those varieties. With regard to assessing the overall impact of an effective PVP system from a global viewpoint, it is, therefore, reasonable to look at the number of new varieties. A direct measure of the number of new varieties is provided by the number of applications for protection (applications) and the number of titles of protection granted to new varieties of plants (titles). The number of applications and titles are meaningful measures of the impact of PVP, since they indicate new varieties which have potential importance within the territory concerned. It is recognized that, in a market economy, the value of a variety is ultimately determined by whether it is commercially successful. Therefore, the fact that, in general, breeders do not pursue protection on varieties which are unlikely to be successful or where protection is not important, would seem to offer further confirmation that the number of applications and titles are good indicators of the benefits of a PVP system.

Thus, an illustration of the overall impact of the UPOV system is provided by the number of titles of protection in force within UPOV. Fig. 2 shows the number of titles in force with UPOV members and the Community Plant Variety Office of the European Community (CPVO) for the period 1974 to 2007. The CPVO is a European Community agency which manages a system of plant variety rights, in con-

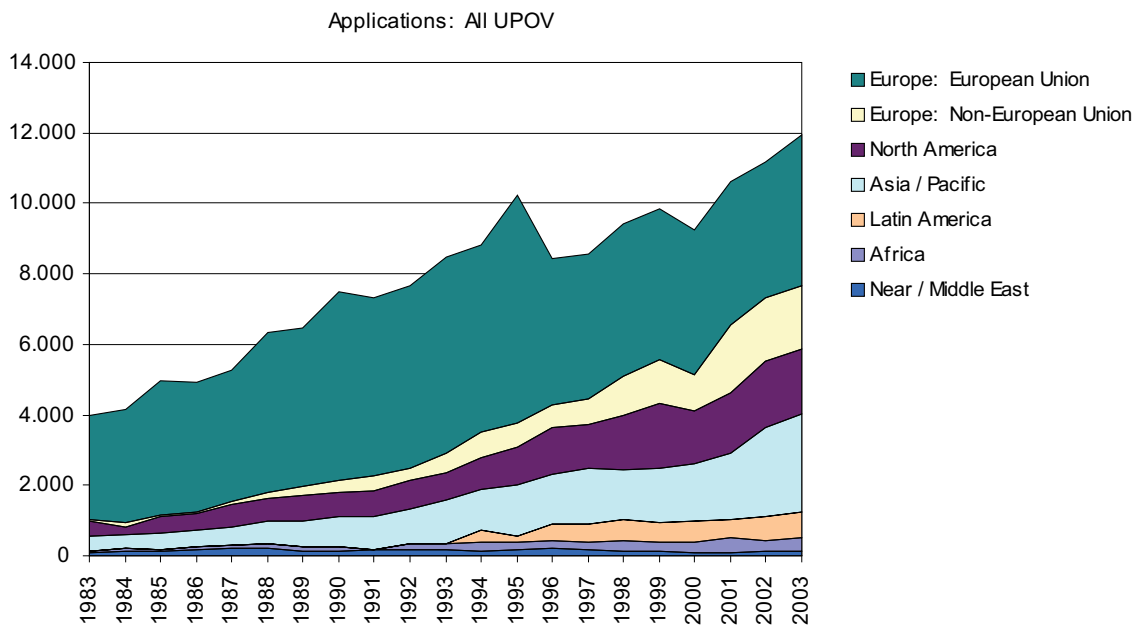
fornity with the 1991 Act of the UPOV Convention, covering the member States of the European Community (Community PVP system). The CPVO data have been included since their introduction in 1995 because, whilst the European Community only became a member of UPOV in 2005, most of the member States were members of UPOV in 1995.

Fig. 2 Titles in Force: All UPOV and CPVO



With the expansion of UPOV, the importance of PVP has grown in different regions, as illustrated by the number of applications presented in Fig. 3. The growth in the UPOV membership of countries from Asia, Latin America and countries in transition to a market economy between 1983 and 2003 is reflected in their growing use of the PVP system.

Fig. 3 Applications: All UPOV and CPVO: by region



Expanding the Protection across Plant Genera and Species

The UPOV Convention recognizes that it is important to encourage breeding in all plant genera and species and not to attempt to pre-determine for which genera and species breeding would, or might, be beneficial. In 1975, protection had been granted to varieties of approximately 500 plant genera or species, growing to around 900 by 1985 and over 1,300 by 1995. It is estimated that protection had been sought for varieties of more than 2,500 genera or species by 2008.

Expansion of UPOV: a Benefit for New and Old UPOV Members

The following section observes the way in which the expansion of UPOV benefits older and newer UPOV members. To look at the situation from the perspective of oldest and newest members, the section categorizes countries into those which were UPOV members by 1992 (older members) and those which became members at a later date (newer members). The year 1992 was chosen because, as can be seen in Fig. 2, that year signified the end of a period of fairly stable membership and the start of a continuous expansion in membership.

Older UPOV Members: the European Community Countries

Fig. 4 demonstrates how the European Community has offered an increasingly important market for breeders from outside the European Community. On the other hand, Fig. 5, which analyzes the number of applications made by residents of 10 European Community countries (Belgium, Denmark, France, Germany, Ireland, Italy, Netherlands, Spain, Sweden and United Kingdom: those which were UPOV members by 1992) with UPOV members other than those belonging to the European Community countries, demonstrates that the expansion of UPOV has presented increased opportunities for breeders based in the European Community.

Fig. 4 CPVO Applications

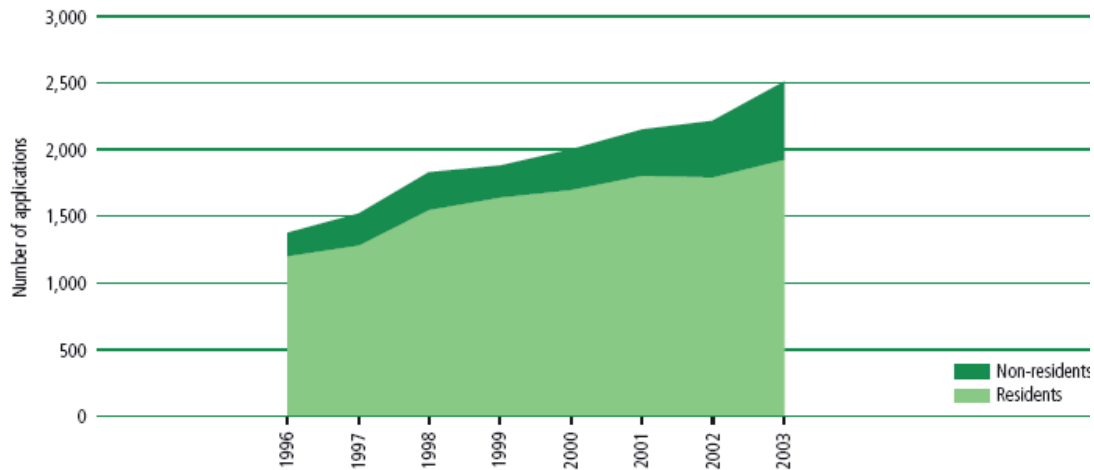
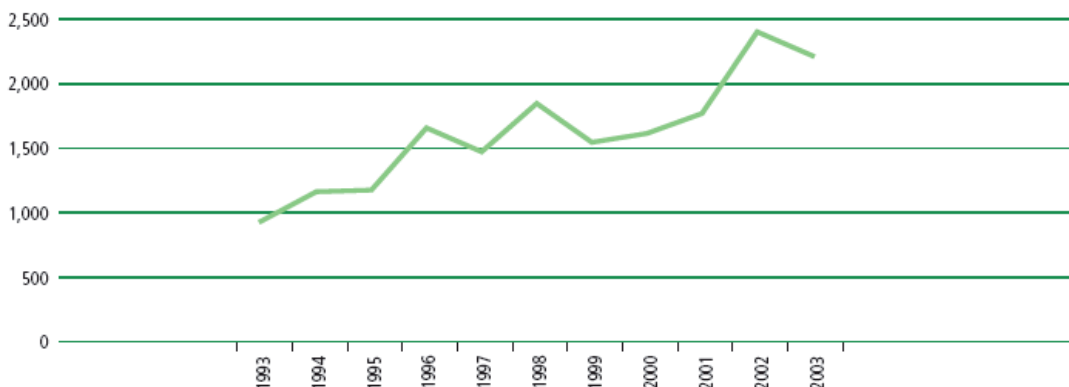


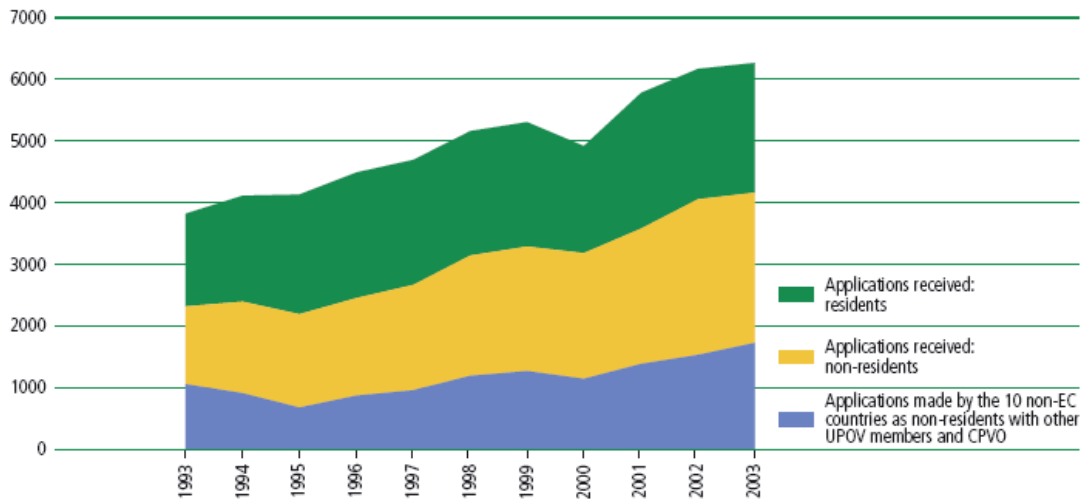
Fig. 5 Applications by 10 European Community Countries (UPOV members by 1992) as Non-Residents outside the European Community



Older UPOV Members: Other Countries

An overview of developments with regard to the other 10 older UPOV members (Australia, Canada, Hungary, Israel, Japan, New Zealand, Poland, South Africa, Switzerland, United States of America) which were UPOV members by 1992, is provided in Fig. 6. In a similar way to developments for the European Community, that group of countries has also seen an increase in the number of applications received, particularly from non-residents and also shows that the number of applications made by their breeders in other territories has also increased.

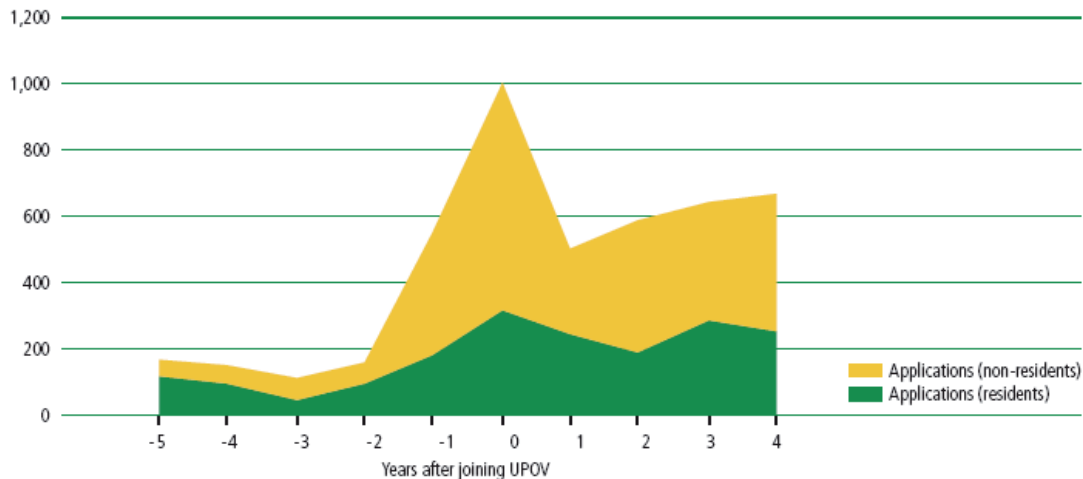
Fig. 6 Ten Non-EC Countries (UPOV Members by 1992)



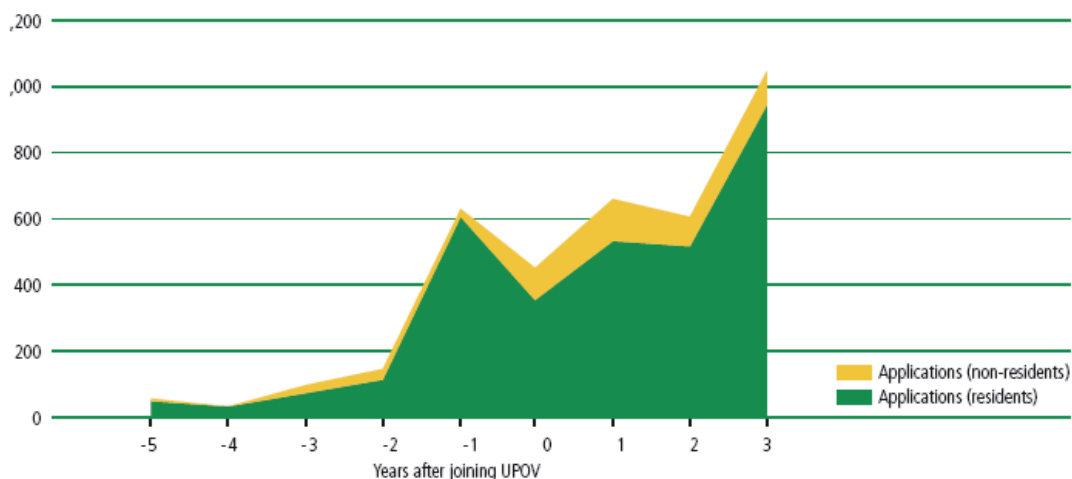
Newer UPOV Members

With regard to countries which have joined UPOV more recently, it is already possible to consider impacts which became apparent immediately on joining UPOV, or soon thereafter. The majority of countries which joined UPOV between 1993 and 2000 and, therefore, for which it has been possible to obtain useful data, were countries in transition to a market economy (Bulgaria, Czech Republic, Estonia, Kyrgyzstan, Republic of Moldova, Russian Federation, Slovakia, Slovenia and Ukraine) or were Latin American countries (Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Panama, Paraguay and Uruguay). An overview of developments in those two categories is provided below. Of the remaining seven countries which joined UPOV between 1993 and 2000 (Austria, China, Finland, Kenya, Norway, Portugal and Trinidad and Tobago), China and Kenya were the subject of individual country profiles in the Impact Study.

An overview summary of the 10 Latin American countries which joined UPOV between 1993 and 2000 is provided in Fig. 7. It is apparent that joining UPOV was characterized by a substantial demand for variety protection and, in particular, a large influx of foreign varieties (applications by non-residents). A high proportion of non-resident applications relate to ornamental varieties. In that regard, it can be observed that access to such varieties is important to enable producers in those countries to meet the demands of the global market place and indicates how the lack of an effective and internationally recognized PVP system can act as a barrier to global trade.

Fig. 7 Latin America Countries acceding to UPOV between 1994 and 2000

An overview summary of the countries in transition to a market economy which joined UPOV between 1993 and 2000 is provided in Fig. 8. It is apparent that joining UPOV was accompanied by a substantial demand for variety protection, with the majority of applications made by domestic breeders.

Fig. 8 Countries in Transition to a Market Economy acceding to UPOV between 1993 and 2000

The results demonstrate that joining UPOV was accompanied by a strong demand for protection of new varieties of plants, both in Latin American countries and countries in transition to a market economy. The nature of the demand differed between the two sets of countries, with a particularly high demand for ornamental varieties from non-resident breeders in Latin America, in contrast to a higher demand from resident breeders in countries in transition to a market economy. This picture highlights the fact that an effective PVP system responds to the circumstances in the territory concerned and provides benefits where these can be obtained. The individual country reports illustrate further the different ways in which the benefits may be manifested.

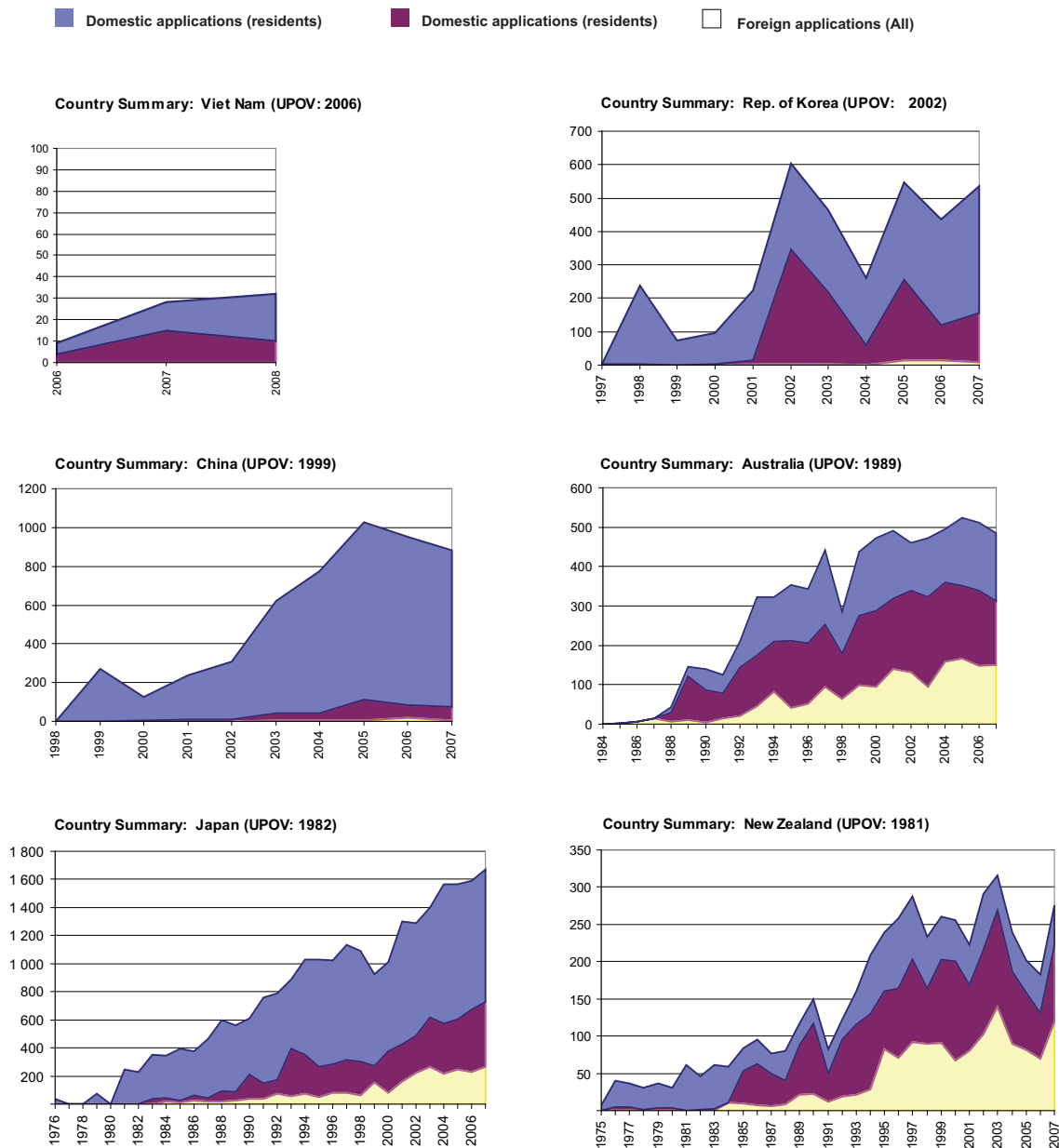
Evolution of Use of Plant Variety Protection

The development of plant variety protection in the Asia Pacific region provides an opportunity to observe the evolution of use of the plant variety protection by breeders over time.

The graphs in Fig. 9 are presented in the order in which those countries became UPOV members: New Zealand (1981), Japan (1982), Australia (1989), China (1999), Republic of Korea (2002) and Viet Nam (2006). No applications have yet been received in Singapore.

In the case of China, Republic of Korea and Viet Nam, which are new UPOV members, it is possible to see that the first use of the system is by residents for domestic applications. Thereafter, it is possible to see that applications from non-residents follow and increase with time. Japan has been a member since 1980 and it is possible to see that same pattern: the first impact is of domestic Japanese breeders making use of the system and, thereafter, applications by non-residents (foreign breeders). The next step, which can be seen in the graphs for Australia, Japan and New Zealand, is that breeders from those countries start to make applications in other UPOV member countries (foreign applications). In the case of China and the Republic of Korea, it can be seen that this stage has also been reached.

Fig. 9 Evolution of Plant Variety Protection in Asia Pacific Region



Reports on Studies Conducted in Individual Countries

It is apparent that the impact of PVP will vary country-by-country and crop-by-crop. Accordingly, although substantial benefits have been seen across the range of UPOV members and, in particular, in each of the countries in this study, the results and conclusions of the study need to be seen in the context of the individual situations. The Impact Study provides information on individual country studies in Argentina, China, Kenya, Poland and the Republic of Korea. The results found in Kenya and the Republic of Korea are presented in separate papers at this Conference.

The Impact Study produced a number of findings concerning the impact of plant variety protection, which might be summarized as follows:

(a) Breeding activity and structure of the breeding industry

The introduction of the UPOV system was associated with increased breeding activity and with the encouragement of new types of breeders, including private breeders, researchers and farmerbreeders. The introduction of PVP was also associated with the development of partnerships, including public-private cooperation.

(b) Improved varieties

Individual country reports in the Impact Study confirmed that the introduction of plant variety protection was associated with the development of new, protected varieties that provided improvements for farmers, growers, industry and consumers.

(c) Increased number of new varieties

The Impact Study provided information on how the number of new varieties increased after the introduction of plant variety protection. It was also demonstrated that membership of UPOV was associated with an increase in the number of varieties introduced by foreign breeders, particularly in the ornamental sector.

(d) Development of international markets

One of the benefits of plant variety protection is to encourage the development of new, improved plant varieties that lead to improved competitiveness in foreign markets.

(e) Enhanced access to foreign germplasm

In addition to providing improved competitiveness for farmers, growers and industry, access to foreign plant varieties is an important form of technology transfer that can also lead to enhanced domestic breeding programs as a result of the breeders' exemption.

ANNEX 1 MEMBERS OF UPOV AS OF SEPTEMBER 8, 2009 (67)

Chile ²	Hungary ³	Nicaragua ²	Sweden ³
China ²	Iceland ³	Norway ²	Switzerland ³
Colombia ²	Ireland ²	Panama ²	Trinidad and Tobago ²
Costa Rica ³	Israel ³	Paraguay ²	Tunisia ³
Croatia ³	Italy ²	Poland ³	Turkey ³
Czech Republic ³	Japan ³	Portugal ²	Ukraine ³
Denmark ³	Jordan ³	Republic of Korea ³	United Kingdom ³
Dominican Republic ³	Kenya ²	Republic of Moldova ³	United States of America ³
Ecuador ²	Kyrgyzstan ³	Romania ³	Uruguay ²
Estonia ³	Latvia ³	Russian Federation ³	Uzbekistan ³
European Community ^{3,4}	Lithuania ³	Singapore ³	Viet Nam ³
Finland ³	Mexico ²	Slovakia ^{3,5}	
France ²	Morocco ³	Slovenia ³	(Total 67)
Georgia ³	Netherlands ³	South Africa ²	
Germany ³	New Zealand ²	Spain ³	

¹ 1961 Convention as amended by the Additional Act of 1972 is the latest Act by which one State is bound.

² 1978 Act is the latest Act by which 22 States are bound.

³ 1991 Act is the latest Act by which 43 States and one organization are bound.

⁴ Operates a (supranational) Community plant variety rights system which covers the territory of its 27 members.

⁵ Slovakia will become bound by the 1991 Act on June 12, 2009.

ANNEX 2 STATES (17) OR ORGANIZATIONS (1) WHICH HAVE INITIATED WITH THE COUNCIL OF UPOV THE PROCEDURE FOR BECOMING MEMBERS OF THE UNION

Armenia, Bosnia and Herzegovina, Egypt, Guatemala, Honduras, India, Kazakhstan, Malaysia, Mauritius, Montenegro, Peru, Philippines, Serbia, Tajikistan, The former Yugoslav Republic of Macedonia, Venezuela, Zimbabwe, as well as the African Intellectual Property Organization (Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Congo, Côte d'Ivoire, Equatorial Guinea, Gabon, Guinea, Guinea Bissau, Mali, Mauritania, Niger, Senegal, Togo (16)).

ANNEX 3 OTHER STATES WHICH HAVE BEEN IN CONTACT WITH THE OFFICE OF THE UNION FOR ASSISTANCE IN THE DEVELOPMENT OF LEGISLATION ON PLANT VARIETY PROTECTION (45)

Afghanistan, Algeria, Bahrain, Bangladesh, Barbados, Burundi, Cambodia, Congo (Democratic Republic of), Cuba, Cyprus, Djibouti, Dominica, El Salvador, Fiji, Ghana, Greece, Guyana, Indonesia, Iraq, Islamic Republic of Iran, Jamaica, Lao People's Democratic Republic, Lebanon, Libyan Arab Jamahiriya, Madagascar, Malawi, Mongolia, Myanmar, Nepal, Oman, Pakistan, Saudi Arabia, Seychelles, Sri Lanka, Sudan, Suriname, Syrian Arab Republic, Thailand, Tonga, Turkmenistan, Uganda, United Arab Emirates, United Republic of Tanzania, Yemen, Zambia.

DISCUSSION

MR. HOSEA SITIENEI (KENYA SEED COMPANY LTD, KENYA): My question is about the definition of breeder. You have rightly observed that plant breeding is long and expensive and, in most cases, it is the seed companies, universities or national agricultural research institutions that invest a lot of money and the resources in breeding work. So, in your own definition, who is the breeder? Is it the employee who does the work or the company that invests the resources and the time?

ROLF JÖRDENS: The UPOV definition of breeder is the person who bred or discovered and developed a variety, so that can be a natural or a legal person; it is then a matter for national legislation or contracts between the employer and the employee to determine who is entitled to ask for protection. That is not a matter which is regulated by the UPOV Convention in detail. It is a matter for private or national law - arrangements between the employer and the employee.

KEY REQUIREMENTS FOR AN EFFECTIVE SYSTEM OF PLANT VARIETY PROTECTION

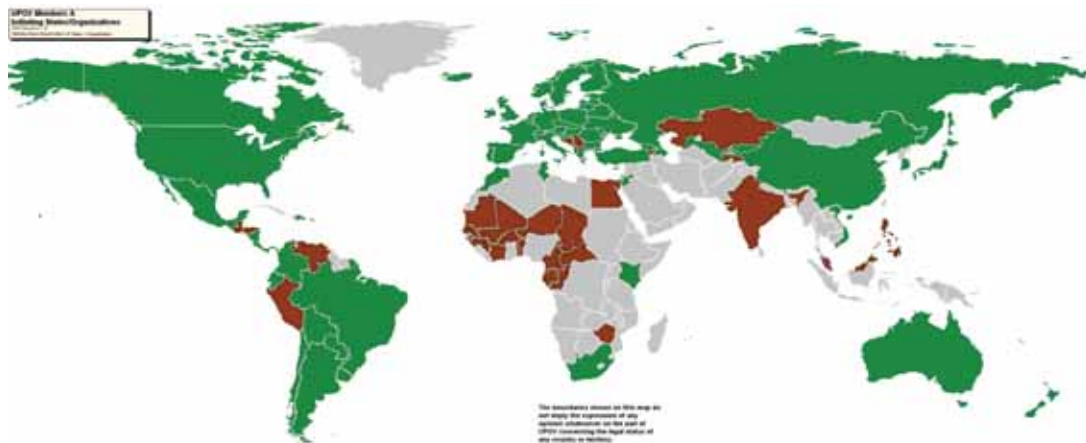
Mr. PETER BUTTON*

Global Perspective

The role of plant variety protection in responding to the challenges of a changing world is to provide a legal framework and system that encourages plant breeding. The presentation “Benefits of Plant Variety Protection”, by Mr. Rolf Jördens, demonstrated how an effective system of plant variety protection and UPOV membership has responded to the various demands of a range of countries. It was explained that many countries, including developing countries and countries in transition to a market economy, are considering the introduction of a system for the protection of new varieties of plants (PVP system). Most countries which have already introduced a PVP system have chosen to base their system on the International Convention for the Protection of New Varieties of Plants (UPOV Convention) in order to provide an effective, internationally recognized system (see Fig. 1). Therefore, this presentation will focus on the UPOV system of plant variety protection and will highlight some of the key requirements that are considered important by UPOV to provide an effective legal framework and system. In addition, consideration will be given to the relationship between plant variety protection and other systems that may impact on the development of new plant varieties.

In this paper, reference to the UPOV Convention concerns the 1991 Act of the UPOV Convention.

Fig. 1 Members of UPOV (green) and Initiating States and Organizations (brown)



Selected Provisions of the UPOV Convention

(a) Breeders and Varieties

Breeder

The person who can apply for plant variety protection by means of a “breeder’s right” is the person who breeds a new variety i.e., the “breeder”. The definition of “breeder” is important because it identifies who is entitled to apply for, and, if the conditions are fulfilled, obtain, a breeder’s right. Article 1(iv) of the 1991 Act of the UPOV Convention defines a breeder as:

* Technical Director, UPOV

- “the person who bred, or discovered and developed, a variety,
- the person who is the employer of the aforementioned person or who has commissioned the latter’s work, where the laws of the relevant Contracting Party so provide, or
- the successor in title of the first or second aforementioned person, as the case may be.”

It is important to note that the concept of “person” embraces both physical persons and legal persons (i.e. companies). The breeder might be, for example, an amateur gardener, a farmer, a scientist, a plant-breeding institute or an enterprise specialized in plant breeding.



The plant-breeding techniques used can range from traditional breeding techniques, such as crossing and selection, through to new technologies, such as genetic engineering. The UPOV Convention makes no restrictions in this regard.

Discoveries can be the initial step in the process of breeding a variety. However, the phrase “the person who bred, or discovered and developed, ...” means that a mere discovery or find would not entitle the person to protection. Development of the variety by the breeder is necessary for a breeder to be entitled to obtain protection.

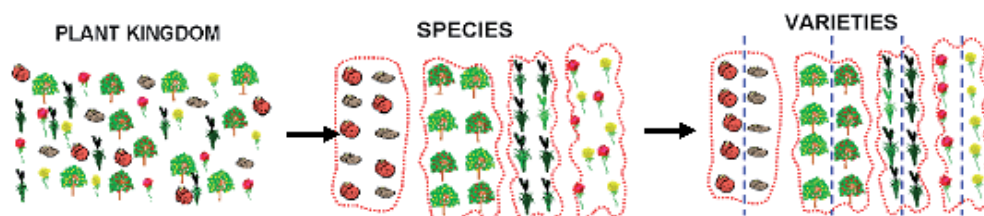
Only the breeder as defined in Article 1(iv) of the 1991 Act of the UPOV Convention is entitled to be granted a breeder’s right. The 1991 Act of the UPOV Convention provides, under its Article 21(1)(iii), that “[e]ach Contracting Party shall declare a breeder’s right granted by it null and void when it is established [...] (iii) that the breeder’s right has been granted to a person who is not entitled to it, unless it is transferred to the person who is so entitled.”

Variety

A variety is the object of protection, which is defined as follows in Article 1(vi) of the 1991 Act of the UPOV Convention:

“variety means a plant grouping within a single botanical taxon of the lowest known rank, which grouping, irrespective of whether the conditions for the grant of a breeder’s right are fully met, can be

- defined by the expression of the characteristics resulting from a given genotype or combination of genotypes,
- distinguished from any other plant grouping by the expression of at least one of the said characteristics, and
- considered as a unit with regard to its suitability for being propagated unchanged.”



(b) Conditions of Protection

The UPOV Convention (Article 5) establishes distinctness, uniformity and stability (DUS) as criteria to be satisfied for the protection of a variety.

Distinctness

A variety is deemed to be distinct if it is clearly distinguishable from any other variety whose existence is a matter of common knowledge (“variety of common knowledge”) at the time of the filing of the application. The term “variety of common knowledge” is not restricted to protected varieties, i.e. to be protectable, a variety must be distinct from all varieties of common knowledge. Furthermore, “common knowledge” is not restricted to national or geographical borders.

Uniformity

A variety is deemed to be uniform if, subject to the variation that may be expected from the particular features of its propagation, it is sufficiently uniform in its relevant characteristics. This notion of uniformity ensures that the variety can be defined as far as it is necessary for the purpose of protection. This is indicated by the notion of sufficiently uniform, i.e., the criterion for uniformity does not seek absolute uniformity. The UPOV Convention links the uniformity requirement for a variety to the particular features of its propagation. This means that the level of uniformity required for truly self-pollinated varieties, mainly self-pollinated varieties, inbred lines of hybrid varieties, vegetatively propagated varieties, cross-pollinated varieties, mainly cross-pollinated varieties, synthetic varieties and hybrid varieties will, in general, be different. Furthermore, it relates only to the characteristics which are relevant for the protection of the variety.

Stability

A variety is deemed to be stable if its relevant characteristics remain unchanged after repeated propagation or, in the case of a particular cycle of propagation, at the end of each such cycle. As with the uniformity requirement, the criterion for stability has been developed to establish the identity of the variety as the subject matter of protection. Thus, the criterion for stability relates only to the relevant characteristics of a variety.

The two other criteria that a variety must fulfill in order to be protected are: novelty, i.e. the variety must be “new” in the sense that it must not have been sold or disposed of to others during a specified period prior to the filing date of the application, and the variety must be given a suitable denomination. The grant of protection must not be subject to any further conditions, provided that the applicant complies with all the formalities and pays the required fees (Article 5).

(c) Breeder’s Right

Duration of Protection

The minimum period of protection (see Article 19) is 20 years from the date of grant of the breeder’s right, or 25 years in the case of trees and vines, which is designed to ensure an adequate incentive for the long-term investment that is necessary in plant breeding.

Scope of the Breeder’s Right: Material Covered

The plant breeder’s right means that the authorization of the breeder of a protected variety (titleholder) is required for certain acts (see Article 14(1)(a) of the 1991 Act of the UPOV Convention). It should, however, be emphasized that the breeder’s right does not give a breeder the right to grow or commercialize the variety. The protection of a variety is independent of the measures regulating the production, certification and marketing of material of varieties. Irrespective of whether a variety is protected or not, there may be provisions of legislation to be met before a variety can be released onto the market; for example, environmental legislation (e.g., concerning the release of genetically modified varieties) and/or variety registration requirements involving a minimum level of agronomic performance (e.g., yield, disease-resistance).

The acts which require the authorization of the breeder of a protected variety with respect to propagating material (e.g., seed, bulbs, tubers, cuttings, etc.), are as follows:

- ▶ Production or reproduction (multiplication)
- ▶ Conditioning for the purpose of propagation
- ▶ Offering for sale
- ▶ Selling or other marketing
- ▶ Exporting
- ▶ Importing
- ▶ Stocking for any of the above purposes

The use of propagating material without the authorization of the titleholder triggers an extension of the breeder's right to the harvested material obtained from that propagating material (i.e. the unauthorized propagating material) of the protected variety. The UPOV Convention, in its Article 14(2), provides the breeder with a right concerning the harvested material as follows:

- The breeder's right extends to harvested material,
- ▶ IF the material is obtained through the unauthorized use of propagating material, and
 - ▶ IF the breeder has not had reasonable opportunity to exercise his right in relation to the propagating material.

In addition, Article 14(3) of the UPOV Convention contains an optional provision which allows members of the Union to extend the scope of the breeder's right to products made directly from harvested material, where this has been obtained through the unauthorized use of harvested material of the protected variety which has itself been obtained from unauthorized propagating material, unless the breeder has had reasonable opportunity to exercise his right in relation to the harvested material.

Scope of the Breeder's Right: Varieties Covered

In addition to the protected variety itself, the scope of breeder's right also applies to the following varieties as stated in Article 14.5 of the 1991 Act of the UPOV Convention (link to Article14.5):

- ▶ varieties which are not clearly distinguishable from the protected variety;
- ▶ varieties whose production requires repeated use of the protected variety.
This provision covers, in particular, varieties which are used to produce hybrid varieties.
- ▶ essentially derived varieties.
The purpose of the provision on essentially derived varieties (EDVs) (see Article 14(5)) is to ensure that the Convention encourages sustainable plant breeding development. The UPOV Convention lists some ways in which an essentially derived variety may be obtained: "Essentially derived varieties may be obtained for example by the selection of a natural or induced mutant, or of a somaclonal variant, the selection of a variant individual from plants of the initial variety, backcrossing, or transformation by genetic engineering."

(d) Exceptions to the Breeder's Right

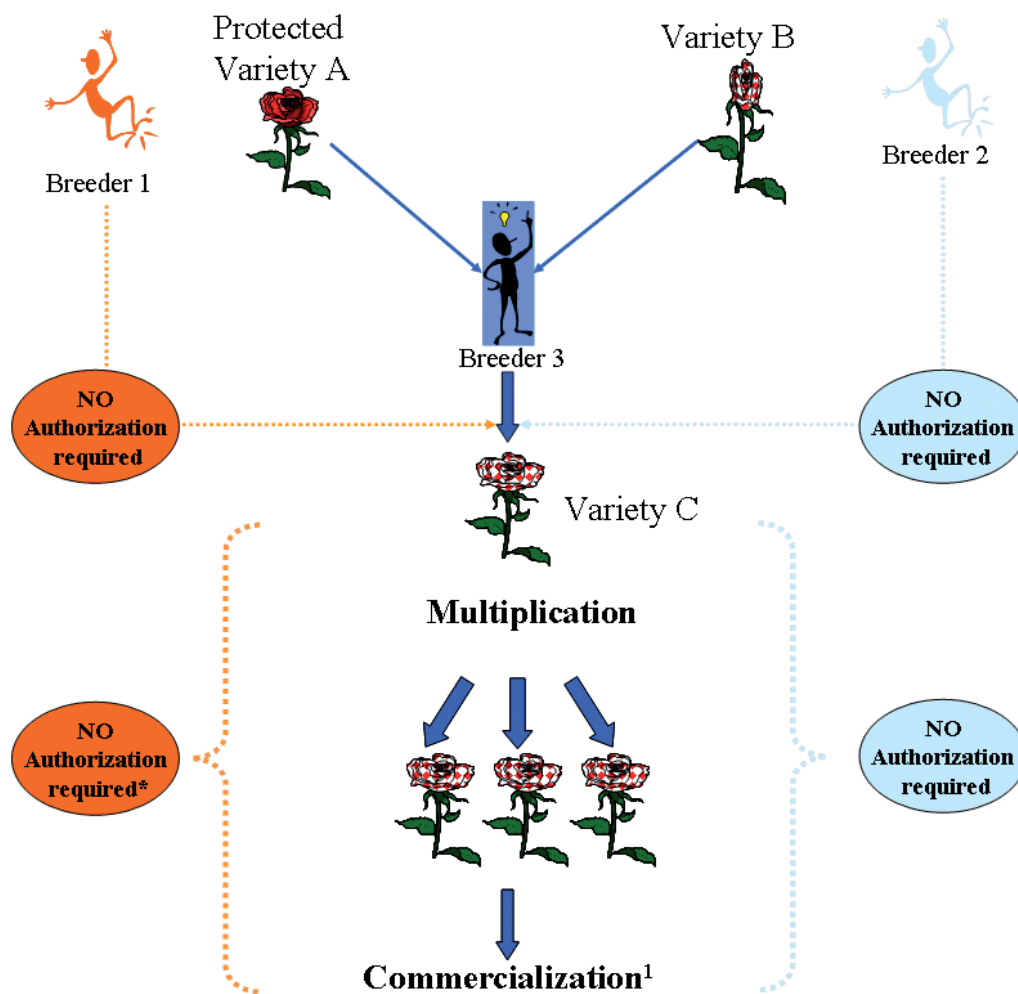
The UPOV Convention establishes compulsory and optional exceptions.

Compulsory Exceptions

- ▶ **Acts done privately and for non-commercial purposes.** For example, the propagation of a variety by a farmer exclusively for the production of a food crop to be consumed entirely by that farmer and the dependents of the farmer living on that holding, may be considered to fall within the meaning of acts done privately and for non-commercial purposes. Therefore, activities, including for example "subsistence farming", where these constitute acts done privately and for

non-commercial purposes, may be considered to be excluded from the scope of the breeder's right, and farmers who conduct these kinds of activities freely benefit from the availability of protected new varieties.

- ▶ **Acts done for experimental purposes.** The breeder's right does not extend to the use of the protected variety for experimental purposes.
- ▶ **"Breeder's exemption."** The exception under Article 15(1)(iii) states that the breeder's right shall not extend to "acts done for the purpose of breeding other varieties, and, except where the provisions of Article 14(5) apply, acts referred to in Article 14(1) to (4) in respect of such other varieties." This is a fundamental element of the UPOV system of plant variety protection known as the "breeder's exemption", whereby there are no restrictions on the use of protected varieties for the purpose of breeding new plant varieties. The wording also clarifies that, except for the varieties included in Article 14(5), i.e. essentially derived varieties; varieties which are not clearly distinguishable of the protected variety and varieties whose production requires the repeated use of the protected variety, the commercialization¹ of the new varieties obtained does not require the authorization of the title holder of the protected variety used to create those new varieties.



* Except for:

- varieties which are essentially derived from the protected variety, where the protected variety is not itself an essentially derived variety,
- varieties which are not clearly distinguishable in accordance with Article 7 from the protected variety and
- varieties whose production requires the repeated use of the protected variety.^d

¹ In this document the term "commercialization" is used to cover the acts included in Article 14(1) to (4) of the 1991 Act of the UPOV Convention.

Farm-Saved Seed (Optional) Exception

The Convention explains that, “[n]otwithstanding Article 14², each Contracting Party may, within reasonable limits and subject to the safeguarding of the legitimate interests of the breeder, restrict the breeder’s 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 or a variety covered by Article 14(5)(a)(i) or (ii)”.

The inclusion of the optional exception in the 1991 Act of the UPOV Convention recognizes that, for some crops, there has been a common practice of farmers saving the product of the harvest for propagating purposes, and this provision allows each member of the Union to take account of this practice and the issues involved on a crop-by-crop basis, when providing plant variety protection. The use of the words “within reasonable limits and subject to the safeguarding of the legitimate interests of the breeder” is consistent with an approach whereby, if the optional exception is implemented, it is done in a way which does not undermine the incentives provided by the UPOV Convention for breeders to develop new varieties.

Cooperation

It is estimated that, within UPOV members, protection has been sought for varieties of more than 2,500 genera or species. In 2007, more than 10,000 titles were granted to breeders by UPOV members. These figures indicate the scale of the UPOV system and demonstrate why cooperation between UPOV members is a key benefit of UPOV membership. In that respect, the guidance developed by UPOV for DUS testing promotes harmonization between members of the Union, thereby facilitating the exchange of information and reports of DUS testing. UPOV members have provided information on their practical experience in DUS testing for more than 2,000 genera and species on the basis that they are willing to share that experience with other UPOV members. Furthermore, there are agreements for cooperation in DUS testing between UPOV members in relation to more than 1,300 genera and species.

Conclusion

The role of plant variety protection in responding to the challenges of a changing world is to provide a legal framework and system of implementation that encourages plant breeding. Some of the key requirements have been set out in this paper. In order to respond effectively to the challenges of a changing world, there is an urgent need to provide an enabling framework that encourages creativity in all its forms, and plant breeding in particular. This requires an appropriate legal framework for an effective implementation of plant variety protection. The legal framework established by the UPOV Convention and the systems established by UPOV members for its implementation, including in particular the guidance and cooperation between members, have been shown to be successful in meeting the aims of plant variety protection (see paper on “Benefits of Plant Variety Protection”).

² Article 14 “Scope of the Breeder’s Right”

DISCUSSION

ADRIENNE LEGER (AGRICULTURE AND AGRI-FOOD, CANADA): You mentioned that, for the distinctness criterion, the variety needs to be clearly distinguishable. How is that done?

PETER BUTTON: Essentially, in most cases, distinctness is examined on the basis of a growing trial - a field growing trial - where the new variety is grown alongside other varieties, existing varieties of common knowledge, to ensure that it is different from those other varieties. This is a very simple summary, but the examination of distinctness is a very important part of the UPOV system and when you are dealing with applications for over 2,500 plant genera and species within UPOV, this is really quite a challenge and this is why international cooperation is really key in the UPOV system. Without that cooperation, UPOV members would have to find a way to develop experience and expertise in all those species - it would be an enormous undertaking. But we have a very efficient system. For example, UPOV members can exchange DUS reports, so that if they don't have experience in a particular species and another UPOV member has already granted protection for that variety, they can use the report from that other UPOV member, because distinctness is a global test. So, if a variety is distinct in one UPOV member, it means that it is distinct globally, not just for that UPOV member.

DOUG WATERHOUSE: And I guess, Peter, the other part is the high-level harmonization. It's not just the DUS cooperation, but the high-level harmonization between the laws, the thresholds and the testing procedures used in all countries.

AAD VAN ELSSEN (PLANTUM NL, NETHERLANDS): You said in your talk that one of the purposes for EDV was to encourage cooperation, but I think that one of the main goals of the EDV concept was to avoid plagiarism and easy breeding. I think that was the main reason, I think you should not forget that it was meant to cover that.

PETER BUTTON: Clearly, the purpose of the EDV provision is to ensure that, for new varieties that are essentially derived from an initial, protected variety, there is a mechanism to ensure that the breeder of the initial variety has control of that variety and is adequately recompensed. That clearly was a major aim. Of course, the possibilities that existed with new techniques was one of the triggers for developing that mechanism, as a means of ensuring that it wasn't an easy way of developing a new, independent variety, with just a very minor change, a cosmetic change. And this was clearly the purpose behind the EDV concept.

FERDINAND SCHMITZ (BUNDESVERBAND DEUTSCHER PFLANZENZUECHTER, E.V, GERMANY): I am wondering whether you have a study about cost efficiency of the system in comparison to other systems. Because, of course, breeders can apply for protection and it is very important, especially for small species and small markets, to have a system that is affordable. And as we have to pay a lot of fees to the offices, we sometimes have doubts. If we compare it to other systems, it might not be too bad. Is there a study available for the benefits of the protection system and the costs which are related to obtaining a title?

DOUG WATERHOUSE: There aren't any current studies directly on that purpose; however, there have been studies in the past and I can answer on behalf of Australia. There was a study in the 1980s that looked at the bench-marking between patents and plant breeders' rights, under a study called "Australia's Plant-Breeding Needs". They did an economic survey and compared, not just the registration costs, but the full costs of preparing an application and they found that, generally, an application for plant breeders' rights was at least an order of magnitude cheaper than an application for patents. In Australia, that is still the case today, and I know that because I look after both the plant breeders' rights area and the plant patents area

EXPERIENCES IN KENYA

EVANS O SIKINYI*

Introduction

The Role of Agriculture in Kenya

Kenya has a total land area of 58.26 million hectares of which only 11.6 million hectares (20 per cent) receive adequate rainfall for rain-fed agriculture. The rest is arid or semi-arid. Out of these 11.6 million hectares only 7 million are used for agricultural production. In the early 1960s, Kenya had a population of about 20 million people and this is estimated to be 42 million in 2009. To be able to meet the challenges of the increasing population and demand for food, more land will have to be brought into agricultural production. The agricultural sector contributes 26 per cent of Gross Domestic Product (GDP) directly and 60 per cent of export earnings. Through links with manufacturing, distribution and service-related sectors, agriculture indirectly contributes a further 27 per cent to the country's GDP. About 80 per cent of Kenya's population live in rural areas and derive their livelihood largely from agriculture. However, increased agricultural productivity can only result from intensive utilization of high potential land; the sustainable use of arid and semi-arid areas (ASAL) and the adoption of appropriate technological packages including improved varieties and quality planting materials for all agro-ecological zones.

The challenges posed by global warming have resulted in unreliable rainfall and weather patterns, further complicating the rain-fed agriculture that Kenya has relied on in the past. This has resulted in moving into irrigated agriculture, efficient use of the available water and opening up of new lands for agriculture, which have required new varieties suitable for these new eco-systems and high-quality seeds for improved productivity. Opening up these regions has posed new problems with new pests and diseases, environmental issues such as salinity, all requiring new varieties that can withstand these new challenges. This has therefore called for breeding or availability of new varieties.

The diverse agro-climatic conditions that exist in Kenya have allowed the production of a wide range of crops, including agricultural and horticultural crops from tropical, sub-tropical and temperate plants. The horticultural sector, particularly floriculture, experienced the most growth during the 1990s in terms of production volume and acreage, varietal improvements, the number of growers and exporters. In tandem with this, the Government of Kenya implemented economic reform measures conducive to domestic and foreign investment, including liberalization of foreign exchange controls, establishment of retention accounts by exporters and duty waivers. This encouraged investment by both local and foreign investors, in particular in terms of infrastructure and introduction of foreign varieties. However, they had to be assured that their plant breeders' rights were protected before introduction of their elite new varieties.

The horticultural sector is the second highest earner of foreign exchange after tourism and tea in Kenya. Export volumes of fresh horticultural products grew from 57,363 tons, valued at 2.5 billion Kenya shillings in 1992, to 121,100 tons, valued at 26.7 billion Kenya shillings in 2002 (2009, 1 US\$ = Ksh 75.0 Kenya shillings (approximate)). Floricultural products account for 55 per cent of all horticultural exports. This trend has continued particularly after introduction of the plant breeders' rights system that has encouraged breeding of new varieties, introduction of foreign varieties and improvement of various quality aspects in new varieties. The markets have dictated the type of varieties to be grown, particularly in the horticultural sector, i.e. the varieties of roses that fetch the highest prices, consumer preferences for the cabbages grown, the French bean or green beans resistant to rust, etc.

* Head, Seed Certification and Plant Variety Protection Kenya Plant Health Inspection Service (KEPHIS)

Seed Industry Development in Kenya

Development of the Kenyan seed industry started in the early 20th century and was supported by research on food, industrial and export crops, which supplied seeds and planting material.

The commercial seed sector started with the establishment of the Kenya Seed Company (KSC) in 1956 in Kitale to produce pasture seed for the colonial settlers. KSC continued to play a predominant role until the industry was partially liberalized in the mid-1980s. Full liberalization of the seed industry was effected in 1996. After this, several companies entered the seed business and by 2004, there were 46 (which had risen to 73 in mid-2009) registered seed companies largely dealing in cereals - maize, wheat, barley, oats, triticale and sorghum; oil crops - rapeseed, sunflower, pulses, vegetables, pasture seeds, other horticultural seeds and Irish potatoes. To support the sector the Government initiated research on coffee, pyrethrum, tea, sugar cane, major cereals (maize, wheat, sorghums and millets, rice) horticultural crops, cotton and tree crops. The annual increase in the number of registered seed companies is testimony to the value given to seed-quality matters and to the importance of improvement in agricultural production. Kenya certifies seeds under the OECD seed schemes and ISTA seed rules.

The seed companies (merchants) operate a chain of agents, sub-agents and seed stockists who distribute their seeds throughout Kenya. However, some planting materials and seeds are distributed through non-commercial channels. For example, farm-saved seed and farmer-to-farmer exchange may be used by small-scale farmers and "road-side" nurseries for forest and fruit trees, which may not have clearly documented sources. Various non-governmental organizations (NGOs) and community-based organizations (CBOs) play an important role in the distribution of non-commercial seed.

Institutions involved in Variety Development and the Seed Industry

The Ministry of Agriculture has the major responsibility for creating and promoting an enabling environment for the players in the seed industry through development of effective policies and strategies. It plays an important role in facilitating research, providing advisory and information services, undertaking review of policies and regulatory framework, and ensuring sanitary and phytosanitary measures.

In the past, plant variety development in Kenya was done mainly by the Kenya Agricultural Research Institute (KARI) for food crops, horticultural crops, industrial crops, pasture and fodder crops; the Kenya Forestry Research Institute (KEFRI) for tree-seed development; the Coffee Research Foundation (CRF); the Pyrethrum Board of Kenya (PBK); the Kenya Sugar Research Foundation (KESREF); the Tea Research Foundation of Kenya (TRFK); universities; seed companies and the International Agricultural Research Centers (IARCs). Rose breeders have organized themselves into the Kenya Breeders Group, which represents about 13 international breeders, for development and propagation of roses.

The Kenya Plant Health Inspectorate Service (KEPHIS) was established in 1996 to provide effective service delivery to the seed industry. Its mandate includes, plant variety evaluation, release and registration; plant variety protection; seed certification; plant protection and development and implementation of seed standards, as well as implementation of the national policy on introduction and use of genetically modified plant species in Kenya.

Under the Seeds and Plant Varieties Act, crops listed under Schedule II must undergo compulsory certification to be eligible for marketing as seed. Such crop varieties must be tested under the National Performance Trials for their Value for Cultivation and Use before they are released for commercialization. During the test the varieties must prove that they perform better than the existing varieties on the market. In other words, they are new and improved varieties. Upon release, these varieties are entered onto the National Crop Variety List, which includes all officially released varieties to be in commerce. It does not however list all vegetable crops and ornamental crops. Efforts are underway to create catalogues for the other crops not included.

Plant Variety Protection (PVP) in Kenya - Key Provisions

- ▶ Provisions for the protection of new plant varieties are contained in the Seeds and Plant Varieties Act of 1972, which became operational in 1975. The Act was revised in 1991, official regulations to guide the implementation of PVP service put in place in 1994 and the plant variety protection schemes published in 1997. Kenya acceded to the 1978 Act of the UPOV Convention on May 13, 1999. A revised draft of the legislation, which recognizes emerging national and global developments in the seed industry, has been done
- ▶ Kenya grants plant breeders' rights (PBRs) for all plant genera and species, other than algae and bacteria.
- ▶ Principle of national treatment, which allows nationals of other State members of UPOV to be treated in the same way as Kenyan nationals, as far as plant variety protection is concerned.
- ▶ Provision of interim protection allows an applicant to request a protective direction (interim protection) when applying for plant variety protection. An applicant with a protective direction in force enjoys similar rights as if the right had been granted. The protective direction ceases when a decision on whether the application for the grant of plant breeders' rights is accepted or refused is made, or at such earlier time as is provided under the law.
- ▶ DUS examination for plant variety protection uses central testing, where KEPHIS carries out variety testing, cooperation in DUS testing with UPOV members and testing on breeder premises for special cases.
- ▶ Plant breeders' rights enforcement. The enforcement of rights is the responsibility of the owner of the rights. However, the law provides for the plant breeder whose rights are infringed to seek redress in the courts of law by means of damages, injunction, account or otherwise. The Act also provides for a Plant and Seed Tribunal to determine any disputes arising from plant variety protection. Additionally, KEPHIS, being the designated Authority for phyto-sanitary, seed certification and PVP matters, has the added advantage of helping the enforcement of PBR through the licensing and certification process.

Experiences in Plant Variety Protection

Since the implementation of the PVP system in 1997, a total of 980 applications for PVP have been received. There was a slow rate of application in the initial stages. However, in 2001, there was a sudden surge in PVP applications from domestic breeders, reflecting an increased awareness among breeders in public institutions of the need to protect their varieties and the utilization of the notion of varieties of recent creation provided for under the UPOV Convention. Domestic (Kenyan) breeders have submitted 376 (38.37 per cent) of the total PVP applications, while 604 (61.63 per cent) have been from foreign applicants.

Table 1 Applications Received from 1997 to 2008

Year	Number of Applications		
	Domestic	Foreign.	Total
1997	11	128	139
1998	42	33	75
1999	16	45	61
2000	24	45	69
2001	164	33	197
2002	11	27	38
2003	7	25	32
2004	16	44	60
2005	53	44	97
2006	0	54	54
2007	28	64	92
2008	4	62	66
Total	376	604	980

Domestic Breeders

Domestic applications have been from public institutions (339) and private institutions (37)

Table 2 Public and Private Applications

<i>Type of Institution</i>	<i>Number of applications (1997-2008)</i>
Domestic Public Research Institutes	338
Domestic Public Educational Institutes	1
Domestic Private Companies	36
Domestic Individual Breeders	1
Foreign Entities	604
Total	980

Crops most frequently featured in Applications for Protection in Kenya.

The following Table shows the crop species for which large numbers of applications for protection were filed between 1997 and 2008.

Table 3 Crop Varieties most frequently featured in Applications

<i>Plant Species</i>	<i>Number of Applications (1997-2008)</i>
1 Rose	460
2 Maize	132
3 Tea	39
4 Wheat	32
5 Alstroemeria	31
6 Limonium	24
7 Pyrethrum	23
8 French bean	20
9 Chrysanthemum	19
10 Calla lilies	15

(Source: KEPHIS)

Agriculture Sector

Three hundred and forty-four applications have been filed for agricultural crops, making up 35.1 per cent of the total PBR applications received. Domestic breeders submitted 338 (98.3 per cent) of the applications in the agriculture sector while 6 (1.7 per cent) were foreign in origin.

The PBR applications in the agriculture sector are distributed in categories shown in the Table below:

Table 4 Distribution of PBR Applications for Agricultural Crops as of 2008

Crop	Category	Source of Application			Total
		Non-residents	Residents		
			Public	Private	
Oats	Cereal	-	1	-	1
Finger millet	Cereal	-	2	-	2
Barley	Cereal	-	-	8	8
Proso millet	Cereal	-	1	-	1
Pearl millet	Cereal	-	3	-	3
Sorghum	Cereal	-	7	-	7
Wheat	Cereal	-	32	-	32
Maize	Cereal	6	125	1	132
Tea	Industrial	-	14	25	39
Pyrethrum	Industrial	-	23	-	23
Eucalyptus	Industrial	-	8	-	8
Coffee	Industrial	-	4	-	4
Cotton	Industrial	-	2	-	2
Macadamia nut	Industrial	-	4	7	11
Sugarcane	Industrial	-	6	-	6
Safflower	Oil	-	1	-	1
Sunflower	Oil	-	10	-	10
Castor oil	Oil	-	2	-	2
Soybean	Oil	-	7	1	8
Brachiaria	Pasture	-	1	-	1
Rhodes grass	Pasture	-	5	-	5
Guinea grass	Pasture	-	1	-	1
Setaria	Pasture	-	2	-	2
Clover	Pasture	-	-	1	1
Pigeon pea	Pulse	-	4	-	4
Dolichos bean	Pulse	-	2	-	2
Runner bean	Pulse	-	-	1	1
Dry beans	Pulse	-	13	-	13
Peas	Pulse	7	-	-	7
Cow pea	Pulse	-	4	-	4
Mung bean	Pulse	-	3	-	3
Cassava	Root crop	-	2	-	2
Total					344

Horticulture Sector

The horticulture sector formed the bulk of PBR applications, with a total of 636 applications accounting for 64.9 per cent of the total PBR applications. Foreign breeders submitted 613 (98.4 per cent), while domestic breeders made 10 (1.6 per cent) of the applications in this sector. Applications were received for the following categories of horticultural crops (see Table below):

Table 5 Distribution of PBR Applications for Horticultural Crops as of 2008

Crop	Category	Source of Application				Total
		Non-residents	Residents		Joint public and private	
			Public	Private		
Strawberry	Fruit	3	-	-	-	3
Passion fruit	Fruit	1	-	-	-	1
Raspberry	Fruit	1	-	-	-	1
Pineapple	Fruit	1	-	-	-	1
Avocado	Fruit	3	-	-	-	3
Alstroemeria	Ornamental	31	-	-	-	31
Aster	Ornamental	1	-	-	-	1
Carnation	Ornamental	4	-	-	-	4
Eryngium	Ornamental	1	-	-	-	1
Gypsophila	Ornamental	12	-	-	-	12
Bird of paradise	Ornamental	1	-	-	-	1
Hypericum	Ornamental	1	-	-	-	1
Limonium	Ornamental	18	-	6	-	24
Pelargonium	Ornamental	4	-	-	-	4
Phlox	Ornamental	4	-	-	-	4
Rose	Ornamental	460	-	-	-	460
Solidago	Ornamental	2	-	-	-	2
Tegetes	Ornamental	1	-	-	-	1
Calla Lilly	Ornamental	15	-	-	-	15
Chrysanthemum	Ornamental	19	-	-	-	19

Amaranthus	Vegetable	-	-	4	-	4
Rape seed	Vegetable	14	-	-	-	14
Pepper	Vegetable	1	-	-	-	1
Sweet potato	Vegetable	1	-	-	-	1
Tomato	Vegetable	-	-	1	-	1
Irish potato	Vegetable	-	4	-	-	4
French bean	Vegetable	20	-	-	-	20
Pea	Vegetable	1	-	-	-	1
Soybean	Vegetable	1	-	-	-	1
Total						636

Cash crops (non-food crops which may include agricultural and industrial crops specifically grown for sale and not food security) dominate PVP applications with 774 applications, comprising 78.98 per cent of the total applications in Kenya. The agricultural crop category accounted for 344 applications, making up 35 per cent of the total PVP applications in Kenya. Domestic breeders dominate the agricultural sector with 331 (96 per cent) applications out of the 344. The majority of the applications in the agricultural category are for cereals (oats, maize, barley, finger millet, proso millet, sorghum, wheat and pearl millet). This is followed by industrial crops (pyrethrum, tea, coffee, cotton, macadamia and sugar cane) and pulses (pigeon peas, Dolichos beans, runner beans, dry beans, peas and mung beans).

Horticultural crops account for 636 (64.90 per cent) of the total PVP applications. In contrast to agricultural crops, PVP applications in the horticultural category are dominated by foreign breeders with 610 (97 per cent). Ornamental crops constitute 570 applications, accounting for 90 per cent of the applications for the horticulture sector, 58 per cent of the total PVP applications in Kenya. Foreign applications for ornamental varieties stand at 557 (98 per cent). Roses dominate among the ornamentals with 460 (80.7 per cent) applications, followed by *Alstroemeria* with 31 (5.4 per cent).

Impact of Plant Variety Protection

The UPOV Report on the Impact of Plant Variety Protection ("Impact Study") (http://www.upov.int/export/sites/upov/en/publications/pdf/353_upov_report.pdf) evaluated the impact of plant variety protection and membership of UPOV in Kenya, Argentina, China, Poland and the Republic of Korea. A number of parameters were used in the evaluation including the number of breeding entities, changes to investment in breeding, number of released varieties and the improvement of varieties. A summary of the study findings in Kenya is provided below as well as additional observations that were made.

Number of Breeding Entities

It has been observed that university scientists, who previously conducted academic research, became more interested in breeding commercial varieties, increasing the number of commercial breeders. Lines that had been developed for academic purposes were developed into improved varieties for protection and commercialization. Over the years the number of breeding entities has doubled, as shown in the Table below. It is important to note that there are entities that are involved in breeding several crops or commodities. Similarly, research Institutes such as KARI may have several research stations or centers developing different varieties of the same crop, e.g. maize for the dry zones will be handled by one station in that region, while high-altitude maize varieties will be developed by a different station in the appropriate region. New entrants, such as foreign seed companies, that breed outside Kenya but submit their varieties to the national testing and release system, were seen. Similarly, new domestic companies have access to new varieties developed by international research institutes that are not permitted to officially release them. It should be noted that breeding entities in the floriculture industries have traditionally carried out most of the breeding work outside Kenya. However, there has been a substantial increase in the level of domestic breeding and the type of crops bred in Kenya in the recent past.

Table 6 Number of Breeding Entities per Crop for the Period 1990-1996 and 1997-2003

<i>Crop</i>	<i>1990-96</i>	<i>1997-2003</i>
Maize	9	16
Dry beans	5	9
French beans	1	4
Macadamia	1	2
Tea	2	5
Sweet potato	3	4
Sugar cane	1	1
Cassava	3	4
Irish potato	1	1
Pyrethrum	1	2
Sunflower	2	5
Cotton	1	2
Millet	2	4
Sorghum	3	8
Barley	1	2
Rice	1	3
Wheat	2	5
Cow Peas	2	4
Total	41	81

Investment in Plant Breeding

The level of investment has increased in the breeding and commercialization of new varieties. This has concentrated on the establishment of physical facilities and technology. The level of investment has, however, decreased in public institutions especially in land acreage and financial allocations for plant breeding. This is in contrast to private breeding institutions where financial investment has gone up and fields extended for research and seed multiplication purposes. As stated above, there are new entities which have set up breeding activities, involving land acquisition for research and seed production, seed processing etc. There are also other smaller entities that rent out equipment from existing entities. There has also been collaboration between domestic breeders and the International Institutes where either finished or near-finished products have been acquired for further testing and multiplication.

In general, it is difficult to get details from the breeders on the level of their investment, although it is evident that substantial investment has been made. At the same time, government funding for research has been reduced substantially and some breeding programs have been discontinued. There is a general feeling or policy that public institutions should be able to commercialize their innovations to fund their activities. Contract breeding with the private sector is also being encouraged. Presently, research mainly funded by donor agencies in collaboration with the Kenya Government. KARI for instance has invested in a modern biotechnology laboratory and greenhouses for breeding work at a number of their stations through donor funding. Several universities have similar facilities in place or are in the process of installing them.

As can be seen in Tables 4 and 5, public and private breeders have started to jointly develop new varieties for some crops, such as wheat and maize. PVP plays an important role in promoting this kind of public-private cooperation. It has been observed that some university scientists, previously conducting academic work, have started to breed commercial varieties, thereby increasing the number of commercial breeders (see Boxes 1 and 2). Another type of cooperation is developing between international research institutes under the Consultative Group on International Agriculture Research (CGIAR) and local seed companies, whereby the latter would undertake the commercialization of varieties bred by the former. PVP is expected to play an important role and its modalities are now under discussion. The PVP system also encourages local breeders, including private farmer-breeders, to establish and commercialize new varieties (see Box 3). A private farmer selected her two varieties of *strelitzia*, of which one, "Betsy" has interim protection and is due for grant of breeder's rights after completion of DUS testing.

Box 1

Climbing beans are new types of beans that are suitable for small-holder farmers. These are being bred under institutional and regional collaboration projects involving both university breeders and KARI breeders.

Varieties are being evaluated here for suitability for release and protection.

Box 2

Three varieties of "Quality Protein Maize" have now been released in Kenya through collaborative work between local seed companies, research institutes and the International Maize and Wheat Improvement Center (CIMMYT). These varieties have higher levels of tryptophane and lysine compared to normal maize varieties, thus providing high quality protein for human consumption and for animal feed. PVP facilitates this kind of cooperation by allowing the varieties to be commercialized in a way which ensures that all partners are rewarded for their work.

Box 3

Betsy: a *Strelitzia* variety (right) selected by Mrs. Muriithi (left). Mrs. Muriithi's application for PVP is under examination.

*Number of Released Varieties*

An increased number and range of improved varieties have become available to farmers. The number of varieties introduced by breeders within the period subsequent to the establishment of PVP is significantly higher than in the preceding period, especially for maize. Between 1990 and 1996, only 39 new varieties were released, as compared to 126 between 1997 and 2003 and the introduction of variety protection. Maize constituted about 50 per cent of these varieties. Most of the new varieties are superior to the existing ones, particularly in yield, pest and disease tolerance, nutritional qualities, tolerance to abiotic stress and earliness in maturity. All these varieties must pass through the National Performance Trials to verify the superior characteristics by KEPHIS before they enter commercialization. Since maize is a staple food for 80 per cent of Kenyans, this implies a positive contribution to food security concerns in the country. Three varieties of quality protein maize have now been released in Kenya through collaborative work between domestic seed companies, research institutes and the International Maize and Wheat Improvement Center (CIMMYT). More of these varieties suited for various agro-ecological zones are under test and will be released in the near future. These new varieties are licensed to private companies for effective distribution and wider adoption.

Table 7 Number of Officially-Released Varieties for Crops under the NPT (VCU) Tests per Crop from 1998 to 2008.

Year	Maize	Bush bean	Climbing bean	Sweet potato	Cassava	Pearl millet	Sorghum	Wheat	Potato
1998		1		3	3		3	3	2
1999	2			1				3	
2000	8					2	3		
2001	13			4		1		3	
2002	10								
2003	21								
2004	22								
2005	4								
2006	11								
2007	7							2	
2008	42	11	3		6		4	2	
Total	140	12	3	8	9	3	10	13	2

Improvement of Released Varieties

Previously, varieties were assessed for release on the basis of their yield performance. However, in the recent past varieties have been released on attributes other than yield. For instance, it is a requirement that for any new maize varieties to be released they must have a specified level of tolerance/resistance to turicum blight and grey leaf spot, as a minimum, in addition to other characteristics. Other aspects that have been used include quality, such as quality protein in maize, baking quality in wheat, disease and pest resistance, brewing quality in barley, etc. These requirements have demanded improvement on the already released varieties. For example, a number of maize varieties are being converted to quality protein maize with resistance to abiotic and biotic stresses.

The provision of the breeder's exemption has allowed Kenyan breeders to develop new varieties of French beans resistant to rust using the released or protected varieties as sources of variation. These varieties are in the final stages of release.

With regard to plants that are not covered by the variety release requirements, such as ornamental crops, the availability of globally important varieties, as a result of offering protection to breeders of those varieties, has resulted in increased opportunities for the flower industry, as explained below.

Additional Observation and Findings

Increased Breeding Activities, Commercialization and Collaboration

An increased level of activity has been observed in the seed market among domestic and foreign breeders. At the same time, increased collaboration of domestic breeders with foreign breeders and international institutions has been reported. This involves capacity-building, funding, germplasm exchange and commercialization of foreign varieties in Kenya. Domestic breeders have also extended partnerships with farmers for on-farm testing of newly bred varieties. Domestic entities receive and market new materials from foreign breeders on their behalf or under license. Alternatively, these breeders have incorporated their companies domestically to market their new varieties.

Enhanced Access to Foreign-Bred Materials

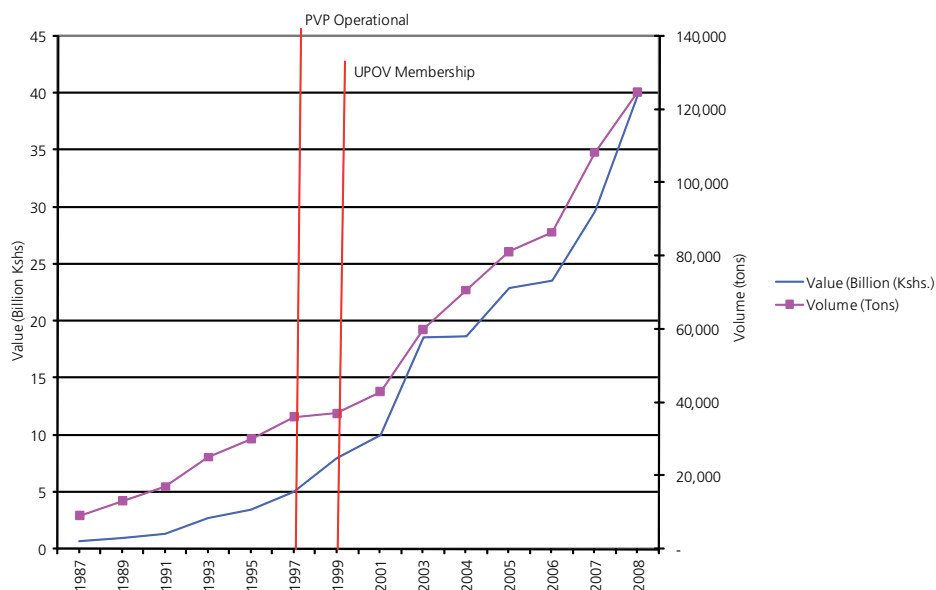
Most of the applications for PVP in Kenya are from foreign breeders (55 per cent). This demonstrates increased availability of foreign germplasm, which can be used further in developing improved vari-

eties in accordance with the breeder's exemption in the UPOV Convention. For example, a breeder at Moi University has developed a number of lines from an introduced foreign-protected variety crossed with a local bean variety that has rust resistance. One of the developed lines is under trial for protection and commercialization (see Box below).

Generation of Foreign Exchange and Employment

More than half (52 per cent) of the varieties for which PVP has been applied in Kenya are ornamentals. Given the conducive weather conditions for flower and ornamental plant production, Kenya has continued to attract a number of breeders to grow their new varieties for the European market. Kenya remains the largest single source of floriculture imports into the European Union. To sustain production, the floriculture industry employs a large labor force, which is an important source of income for the small-scale farmers located in the rural areas. It is estimated that the horticultural industry employs 2 million people directly in breeding, production, packaging and transport. Another 3.5 million people are supported indirectly by the industry, for instance in marketing, the hospitality industry, manufacturing of containers, etc. There are over 160 professional-size growers, who include small-scale (under 4 hectares), medium-scale (10 to 50 hectares) and large-scale growers (over 50 hectares). In the early stages of development, there were a few large-scale growers dominating the industry. However there are now more than 100 medium- to large-scale growers. In 2003, Kenya exported over 61,000 metric tonnes of cut flowers to Europe, up from 52,000 metric tonnes in 2002. The value of that export was 216 million US dollars. On overall horticultural production in 2008, 7 million tons were produced and used domestically, while 403,000 tons were exported, accounting for about 4 per cent of total production. These were worth 1.8 US dollars billion for the domestic market and 1.0 billion US dollars in export markets.

Fig. 1 Export of Kenyan Cut Flowers



Summary and Observations

During the 10 years (1997 to 2008) that the PVP system has been operating in Kenya, the following observations have been made on the impact of the introduction of the PVP system and the accession to the UPOV Convention:

The establishment of the PVP system in Kenya has stimulated interest in commercial breeding which has spread all over the country, but in particular in the private sector and in the horticultural sector which is now found in newly opened areas and regions.

- ▶ Increased investment in plant breeding, particularly by the private sector.
- ▶ Increased competition and collaboration in the seed industry in terms of variety development and marketing of new varieties.
- ▶ Increased awareness of the benefits of plant-variety protection by breeders and employers.
- ▶ Most research institutions and breeding entities now have institutional Intellectual Property policies and Intellectual Property offices in place to guide technology development and transfer.
- ▶ Increase in the number and range of foreign varieties which are used for agricultural production and source of variation for further domestic breeding of new varieties.
- ▶ Creation of employment and foreign exchange earnings from the increased production in the horticultural sector, particularly for export.
- ▶ More domestic varieties are tested for release and commercialization by the domestic breeders for the domestic market.

Conclusions

Kenya has been faced with a wide range of challenges due to a changing world. These changes have included global warming which has affected the weather patterns and traditional agricultural practices which have required new technologies. The population increase demands increased food production, which requires increased productivity and expansion of production areas. This was previously limited by the available arable land, but it may be solved by new technologies for farming in the more arid land that is available. Similarly, farmers have had to move from subsistence farming to more commercial or business farming. In all this, new plant varieties and quality seeds have had to play a major role in meeting the challenges. New plant varieties and crops have been used to produce crops and food in areas not traditionally used for production. The floriculture industry in Kenya has flourished and is a major income earner and employer and supports millions of Kenyans. This has been driven by changing demands in consumer preferences and availability or ability to provide new varieties to meet the demand. Breeding new varieties and particularly the introduction of new foreign varieties has been crucial in cases where domestic breeding faced challenges in developing appropriate varieties.

Plant variety protection has played a greater role in meeting these challenges since it encourages innovation and investment in breeding, introduction of new varieties and commercialization of agricultural production. High quality seeds of the new varieties have been shown to be a sure way to meet the challenges of the changing world.

DISCUSSION

FRANÇOIS BURGAUD (GNIS, FRANCE): Dr. Sikinyi showed a map of Africa and the situation of breeders' rights in Africa and the map is linked to the membership of UPOV, but it doesn't reflect the situation on legislation. So I would like just to add that 16 countries are members of the African Intellectual Property Organization (OAPI), which already has legislation on plant breeders' rights that is implemented and there are some protected varieties. There are also some countries in North Africa with legislation, so the situation is not as bad as it looks on Dr. Sikinyi's map.

DOUG WATERHOUSE: I also saw that Dr. Jördens had a map which demonstrated the point that you have made.

ROBERT GUEI (FAO): Firstly, can you actually tell us about the experience of your country in terms of law enforcement, because law enforcement is very important? How do you do that in Kenya? Secondly, when you talk about foreign germplasm or varieties coming in, are you talking only about the private sector, or are you talking also about Consultative Group on International Agricultural Research (CGIAR) centers? It is not clear to me what role the CGIAR centers based in Kenya play.

EVANS SIKINYI: Maybe one of the issues when we implemented plant breeders' rights was the question of enforcement. KEPHIS, as an organization, is in a better position because apart from issuing plant breeders' rights, it is also responsible for the inspection of material that is exported. We have records of all seed certification exported material, so we are in a position to assist in enforcement. In terms of foreign varieties, these were from the private sector. However, there is a lot of collaboration between local breeders and the international research centers which we have in Kenya. They have assisted in the development of releasing varieties, although materials from international research centers have not been entered for protection, but are available for commercialization. However, if breeders further develop the material from international research centers, they are free to protect it – as long as it has been further developed into a new variety.

JEAN-LOUIS DUVAL (JLDUVAL CONSULTING SARL, FRANCE): Was the public sector in Kenya reluctant to become involved in enforcement?

EVANS SIKINYI: The plant breeder's right is a private property right and enforcement is for the owner of the variety, the one with the grant. However, as an office, we will assist in cases of infringement where we can provide evidence. However, as I said, KEPHIS has gone out of its way to try and assist in keeping records. Most of the applications from local breeders are from public institutions. One of the reasons why public institutions were a little bit slow to apply for protection was a lack of awareness and also a lack of IP policy, because the breeders didn't see what was in it for them. The institutions did not initially understand why they should put in money to protect varieties. So with awareness, awareness-creation, and now also putting IP policies in place where institutions are spelling out what would be the benefit to the breeder or the benefit to the institution, there's more interest in protecting new varieties.

EXPERIENCES IN THE REPUBLIC OF KOREA

Mr. CHANG HYUN KIM*

Introduction

The Republic of Korea introduced its Plant Variety Protection (PVP) system in 1997. There were several reasons for its introduction at that time.

First, there was a strong demand to develop the breeding industry. Korean modern breeding started in the 1950s, when Dr. Woo Jang-Choon, who demonstrated the genetic relationship between six species of the genus Brassica, (the "Triangle of U"), led the Central Agricultural Technology Research Institute (CATRI). Dr. Woo and his staff bred many varieties, mainly vegetables, and distributed those basic varieties to private seed companies. Later, many employees of CATRI became private breeders with various seed companies who bred important vegetable varieties such as the hybrid variety of red hot pepper named "Bulam House Put" using a Genic Male Sterility (GMS) line, the first in the world, in 1969. However, breeders could not protect their varieties effectively without a PVP system, although they mainly focused on breeding hybrid varieties. Therefore, they demanded an effective system.

<Triangle of U>



< Dr.Woo Jang-Choon >



Second, there was a need for a legal framework to support the export of agricultural and horticultural products, especially cut flowers and ornamental crops, which have been exported since the mid-1990s. In order to support and facilitate export, new varieties that were adapted for foreign markets were needed by farmers.

However, there has been another consistent challenge, which is that farmers and consumers always want improved varieties which offer better quality and higher yield. To meet this challenge, breeders need an effective incentive to breed new varieties.

This report explains the experiences in the Republic of Korea in meeting those challenges by the introduction of a PVP system and accession to the UPOV Convention.

* Director General, Korea Seed & Variety Service (KSVS)

General View of Agriculture in the Country

Approximately 70 per cent of the Republic of Korea is covered by mountains. Only 15 per cent of the land area is flat, and mostly located along the coast. 17.9 per cent of the land is used for agriculture, while 64 per cent is used for forestry (2007). The Republic of Korea has a temperate climate with four distinct seasons and, in addition, traits of an oceanic climate. Average annual precipitation varies from 1,016 mm to 1,524 mm.

As a result of the rapid economic development of the country, the workforce active in the agricultural sector fell from 49 per cent in the 1940-50s to 6.8 per cent in 2007. The average farm size is now around 1.45 hectares.

The Republic of Korea is a net importer of staple crops. Rice, the most important of these, is the only exception, where domestic consumption can be covered by the national production. The level of domestic self-sufficiency for grain crops is 25.3 per cent. Most other grain crops, such as corn and wheat, have a self-sufficiency level of less than 5 per cent and these crops rely on imports.

Table 1 Cultivated Area by Crop (2007, unit: 1,000 ha.)

Rice	Other Food Crops	Specialty Crops (Industrial, Medicinal)	Vegetables	Fruits	Others
950	211	80	222	148	244

Vegetable production is a very important sector in Korean agriculture, with an annual production value of 7,483 billion won, in comparison with fruit (2,822.3 billion won in 2007). Vegetable production meets the national demand, and some competitive crops, such as sweet pepper and tomato, are also exported. The most important vegetables include hot pepper, Chinese cabbage, radish, cucumber, garlic, water melon and onion. Traditional vegetables, such as perilla, oriental melon and sesame, are also important.

Table 2 Agricultural Production by Crop (2007, Unit: million US\$, 1 US\$ = 929.20 KRW, 2007 Average Exchange Currency)

Rice	Other Food	Vegetables	Fruits	Flowers	Mushrooms	Specialty Crops	Others
8,456.2	1,127.9	8,053.2	3,037.3	994.1	485.5	1,247.1	1,904.2

Among fruit crops, deciduous fruits such as apple, grape, pear and persimmon are important. Flower production has recently increased to respond to the increased demand for ornamental plants by domestic consumers. The Korean export flower business is expanding rapidly.

Short Description of the Seed Industry

The value of the seed market in the Republic of Korea is estimated at 581 million US dollars and, on the basis of a worldwide seed market value of 36.5 US billion dollars, it accounts for 1.5 per cent.

Table 3 The Size of the Seed Market in Korea (Unit: million US\$)

Total	Food./Grain	Horticulture			Forage	Seedling	Others		
		Vegetable	Ornamentals	Fruits			Industrial crops	Mushroom	Seaweed
581	50	150	110	40	20	100	60	40	11

Year 2007, (Source: MIFAFF estimate)

The seed supply of traditional main crops, such as rice, barley, soybean and seed potato, has been mainly conducted by the public sector (KSVS: Korea Seed and Variety Service). Almost all the necessary seed required has been produced domestically. The participation of the private sector in the seed production of these crops is now beginning.

Conversely, private companies have been the main players in the supply of vegetable seed: red pepper, Chinese cabbage, radish, watermelon, oriental melon and onion are the most important seed-propagated vegetable species.

Since some multinational seed companies entered the Korean seed market in the late 1990s, there has been very strong competition between domestic and multinational companies.

It is also important to note that a considerable amount of seed for national vegetable production is produced abroad and shipped into the country, even though many varieties of vegetable crops are bred in Korea. That is due to the unfavorable conditions for vegetable seed production, including climate, high costs, etc. in the Republic of Korea.

Plant Variety Protection System

Law/Regulations

The Seed Industry Law of the Republic of Korea, based on the UPOV Convention, was promulgated on December 6, 1995. The Republic of Korea revised its Law in 1997 in accordance with the provisions of the 1991 Act of the UPOV Convention, and became a member of UPOV on January 7, 2002.

History of 'Seed Industry Law'

- ▶ 1995.12 Established
- ▶ 1997.12 Implemented on Dec. 31, 1997
- ▶ Revision of the Law in a few articles
 - in 1999, 2001: Conformity with the UPOV Convention such as the notion of breeder, variety, denomination, etc.
 - 2003 : Provisional protection revised
 - 2007 : Introduction of dispute settlement mechanism

History of PVP in Korea

- ▶ 1997.12 : Introduced the PVP Scheme
- ▶ 2002. 1 : Joined as the 50th UPOV member
- ▶ 2003. 12 : Strengthened provisional protection came into effect from 2005.3.
- ▶ 2009. 5 : All plant genera and species without six crops are entitled to PVP

* strawberry, raspberry, blueberry, mandarin cherry and seaweed

Authorities

Since 1998, the Korea Seed and Variety Service (KSVS) under the Ministry for Food, Agriculture, Forestry and Fisheries (MIFAFF) has been operating the PVP system in the Republic of Korea.

KSVS is the organization responsible for implementing several regulations (articles) under the law such as recruiting skilled personnel, securing testing fields, equipment and facilities. In addition, KSVS has studied the PVP operation (management) systems of foreign countries in order to develop and implement the PVP system in Korea.

In August 2008, the Korea Forest Seed and Variety Center was established for PVP in the field of forestry, within the Korea Forestry Service.

Genera and species eligible for protection

The number of plant genera and species covered by PVP has increased steadily since the introduction of PVP. As of May 1, 2009, all genera and species became eligible for PVP, except for strawberry, raspberry, blueberry, mandarin, cherry and seaweed.

Accordingly, many varieties from diverse genera and species are expected to be the subject of applications for PVP in future, and applications for foreign varieties are expected to increase. Table 4 shows the change in the number of species eligible for PVP by year. The PVP system in the Republic of Korea is required to cover all genera and species by 2012 at the latest.

Table 4 The Number of Genera and Species Eligible for Protection

Year	1998	2000	2001	2002	2004	2006	2008	2009	2012.1
Increased number	27	30	31	25	42	34	34	All except for six plants*	All plants
Accumulated number	27	57	88	113	155	189	223		

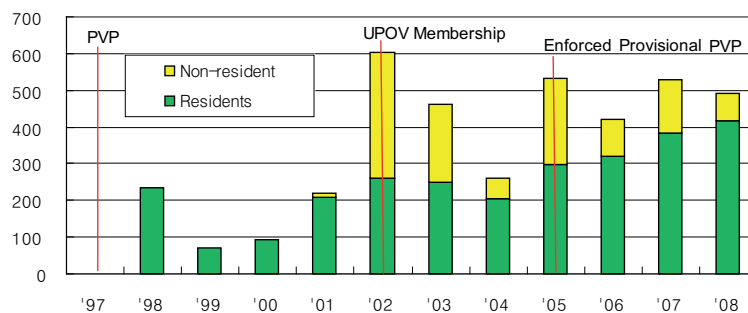
* Excluding certain genera and species of strawberry, raspberry, mandarin, blueberry, cherry, seaweed.

Impact of Plant Variety Protection

Overall Trends of Varieties Available in Korea

(i) Number of Varieties

As shown in Fig. 1, the Republic of Korea recorded a large number of PVP applications by domestic residents immediately after the introduction of PVP in 1997.

Fig. 1 Number of Applications (1998~2008)

Following accession to the UPOV Convention, there have been two noticeable peaks in the number of applications. The first peak was recorded in 2002, the year in which the Republic of Korea acceded to the Convention. The second peak was recorded in 2005 when the provisional protection amendments, introduced in 2003, came into force. Until February 2005, applicants were only provided with provisional protection after the completion of the DUS test. Since March 2005, applicants have the right of provisional protection from the date of publication of the application.

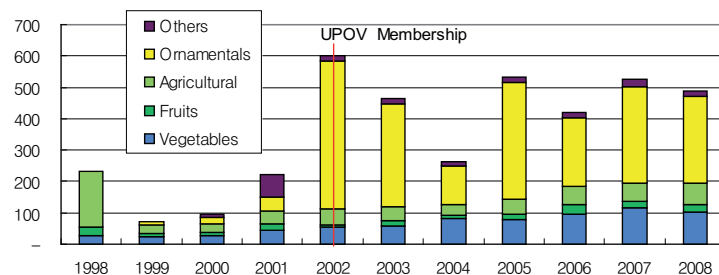
Fig. 2 Number of Applications by Categories of Crop

Fig. 2 demonstrates that the number of applications for PVP in vegetables has increased steadily since its introduction in 1997: the introduction of PVP stimulated domestic breeding very strongly in the vegetable sector. The number of applications for PVP in agricultural species reached a peak in 1998, which was accounted for by a large number of varieties that had recently been developed by government research stations. The PVP Law of the Republic of Korea, in conformity with Article 6(2) of the 1991 Act of the UPOV Convention (varieties of recent creation), enables such varieties to be protected.

In 2002, the year in which the Republic of Korea acceded to the UPOV Convention, there was a wide response in terms of PVP applications for varieties of ornamental species, mainly by foreign applicants. Important ornamental species such as chrysanthemum, lily and rose first became eligible for protection in July 2001.

As shown in Fig. 3, the first PVP title was granted in 2000. Since then the number of titles in force has been increasing continuously.

Fig. 3 Number of PVP Titles Granted and in Force

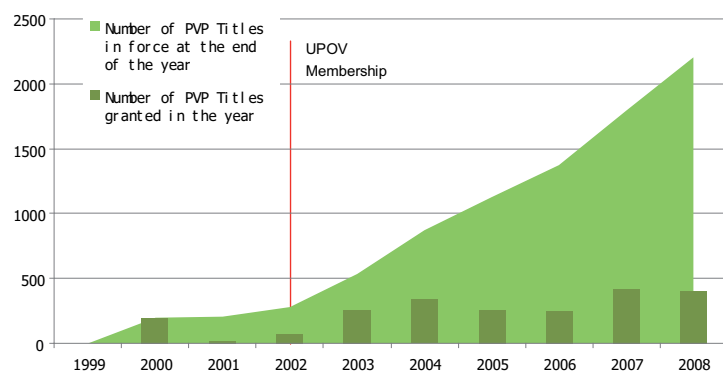


Table 5 shows that farmers in the Republic of Korea have seen the introduction of a number of new, protected varieties of important agricultural, vegetable and ornamental crops.

Table 5 Number of Titles granted from 2000 to 2008 by Crop Category (Top Five Crops)

Order	Agricultural		Vegetables		Ornamental	
	Crops	No.	Crops	No.	Crops	No.
1	Rice	202	Hot pepper	78	Rose	476
2	Soybean	101	Chinese cabbage	52	Chrysanthemum	262
3	Barley	71	Radish	49	Chin cactus	82
4	Maize	48	Water melon	39	Gerbera	81
5	Potato	35	Lettuce	31	Kalanchoe	79

ii) Improvement of Varieties

Since the introduction of PVP in Korea, many improved varieties have been seen in various agricultural and horticultural sectors, for example:

Rice

Recently, there have been changes in the breeding objectives for rice in the Republic of Korea: besides high productivity, new objectives, such as high quality for cooking and processing, reliability for cultivation (e.g. direct seeding, resistance to stress, etc.) and diversification of use (e.g. diet food, healthy food, feed, etc.) have been added.

Rice varieties with high-quality endosperm are demanded by consumers in the Republic of Korea. The endosperm of milled rice in recently developed rice varieties has been significantly improved (see Box 1).

Seoul National University has developed a series of new types of rice varieties. For example, varieties with a giant embryo ("Sunong 6" and "Sunong 8") contain higher levels of various functional components such as oryzanol, phytosterol, tocopherol, and dietary fibers in comparison to varieties with a regular embryo (see Box 2).

Box 1

The premium quality milled rice variety "Ilpum", protected in 2004, with translucent endosperm (left) and the conventional milled rice "Yangjo", protected in 2000, with some white belly (right)

**Box 2**

Varieties with a giant embryo "Sunong 8" (centre), "Sunong 6" (right)



Hwacheongbyeo
(regular embryo
variety) = H

Sunong 8

Sunong 6

Giant embryo variety

Hot Pepper

Varieties which grow well in high temperatures have been bred for cultivation in greenhouses, and varieties which are resistant to phytophthora blight have also been bred (see Box 3).

Box 3 Diversification of Red Hot Pepper Varieties

DokYaCheongCheong (Breeder : Lee YongJik, Ji Yeong-gwon, Syngenta, Korea)

- 1) Strong resistance to phytophthora blight
- 2) Easy growing because of virus resistance
- 3) Low-wilting symptom because of resistance to wet damage
- 4) High yield and good quality of dry fruits
- 5) Correct degree of spiciness
- 6) Easy harvesting



Super Manita (Breeder: Choi Soon Ho, Sim Dong Bo, Nongwoo Bio)

- 1) Variety bred for protected cultivation.
- 2) Large fruit with high pungency.
- 3) High yield by excellent fruit setting.
- 4) Resistant to CMV-fny
- 5) Good quality of dry fruits.



Rose

The diversification of varieties has been rapid in ornamental crops. Most varieties of rose that were introduced and marketed previously were standard types. However, spray and pot type varieties have recently been added to the standard varieties. The favored colors for rose flowers were red, white and pink, but they have been diversified to bi-colors, pastel (orange), green, etc. (see Box 4).

The increased availability of new rose germplasm, resulting from the introduction of foreign rose varieties, has strengthened the rose breeding sector in the Republic of Korea. Applications by domestic breeders have been increasing recently (see Box 13, breeder’s exemption).

Box 4 Diversification of Rose Varieties (Spray Type/Pastel Color)



Ginseng

Eight new ginseng varieties have been bred by private breeders at the Korean Tobacco & Ginseng Corporation (KT&G) and have received a breeder’s right. Applications for the protection of two further varieties have been filed. In ginseng, the percentage of high quality ginseng roots, “red ginseng” is one of the most important commercial characteristics. The newly developed varieties show a high proportion of red ginseng (20 to 38 per cent), compared to 15 per cent for the average conventional ginseng varieties), as well as a higher root yield (see Box 5).

Box 5 High Quality Variety “Chunpoong”



Varieties	Root yield (ton/ha)	Red ginseng percentage
Chunpoong	6.39	38.00
Average of conventional varieties	5.46	15.00

Box 6 KSVS Korea Top Variety Award’s

KSVS has made Korea Top Varieties awards since 2005. The following varieties were selected:



1st (2005)
Apple
“Hong-ro”



2nd (2006)
Rice
“Donggin 1ho”



3rd (2007)
Water Melon
“C-zero”



4th (2008)
Lily
“Dusan”

The key features of those varieties are as follows

Apple

"Hong-ro"

(Breeders: Shin Yong-uk, Kim Whee-cheon, Kang, Sang Jo, Moon Jong-yeol, Kim Jung-ho, Rural Development Administration)

- ▶ Early maturing variety
- ▶ Large fruit, available before Korean Thanksgiving Day
- ▶ Superior skin color (bright red), high sugar content
- ▶ Low production cost due to high density planting and non-bagging
- ▶ Excellent marketability due to low fruit dropping before harvest and skin russetting

Rice

"Donggin 1ho"

(Breeders: Kim Bo-kyeong, Shin Hyun-tak, Lee Jae-Kil, Ko Jae-kwon, Shin Mun-sik, Ko Jong-cheol, Choung Jin-Il, Ha Ki-yong, Kim Ki-young, Kim Young-doo, Nam Jeong-kwon, Kim Yeon-kyu, Kim Soon-chul, Rural Development Administration)

- ▶ Good plant type, medium-late maturing variety, good color of unhulled grain in ripening stage
- ▶ High level of resistance to lodging, abiotic stress, bacterial leaf blight
- ▶ High palatability and milling ratio
- ▶ Wide adaptability

Water Melon

"C-zero"

(Breeder: Lee Sang-jae, Syngenta, Korea)

- ▶ Seedless, triploid variety
- ▶ Easy cultivation due to strong plant vigor, resistance to abiotic stress
- ▶ Low consumption of chemicals due to high level of resistance to biotic stress
- ▶ Excellent marketability in terms of sweetness, flavor, flesh color

Lily

"Dusan"

(Breeder: An Jae Young, farmer-breeder)

- ▶ Variegated, glossy leaf, mild flavor, cut-flower purpose,
- ▶ Pure white colored flower, upward flowering
- ▶ Four to six flower setting, even in scale or small bulb planting superior marketability and suitability for export
- ▶ Strong plant, high level of resistance to biotic stress, easy cultivation management low production cost

(b) Domestic Breeding

(i) Number of Varieties

Table 6 shows the number of applications for PVP filed by residents (domestic breeders). It indicates that, for important agricultural and vegetable crops such as, rice, hot pepper, Chinese cabbage and radish, etc., domestic breeders play a major role. Rice is a main food crop and hot pepper, Chinese cabbage and radish are main ingredients for Kimchi (see Box 7), which is an important side dish in the Republic of Korea. Domestic breeders are also active in the breeding of traditional crops, such as ginseng (see Box 5) and perilla (see Box 8). Foreign breeders predominate in the breeding of ornamental crops (see Table 12). However, some applications for ornamental varieties, such as rose and chrysanthemum, originate both from domestic and foreign breeders. Breeding of Chin cactus varieties is also very active because the Republic of Korea is the largest worldwide exporter (2,522,735 US dollars in 2008) (see Box 9).

Table 6 Number of Applications by Residents by Crop (Top 10 Crops, 1998–2008)

	<i>Crop</i>	<i>No</i>
1	Rice	241
2	Rose	191
3	Chrysanthemum	173
4	Hot pepper	146
5	Soybean	114
6	Chin cactus	108
7	Chinese cabbage	103
8	Lily	91
9	Radish	90
10	Barley	84
	Total	1,341
	Total applications by residents	2,750

Table 6.1 Number of Applications by Residents by Crop (Top Five Crops, 1998–2008)

	<i>Agricultural</i>		<i>Vegetable</i>		<i>Ornamental</i>	
	<i>Crops</i>	<i>No.</i>	<i>Crops</i>	<i>No.</i>	<i>Crops</i>	<i>No.</i>
1	Rice	241	Hot pepper	146	Rose	191
2	Soybean	114	Chinese Cabbage	103	Chrysanthemum	173
3	Barley	84	Radish	90	Chin Cactus	108
4	Maize	79	Water melon	72	Lily	91
5	Potato	47	Lettuce	59	Phalaenopsis	66

Box 7 Kimchi**Box 8 Perilla**

(bred by the Rural Development Administration)

Perilla variety "Bora", developed in 2001 and granted protection in 2004, has high leaf yield for leaf vegetable production and has purple color on the reverse side of the leaf.

**Box 9 Chin Cactus varieties**

Dahong

Hwang-jo

(ii) Number of Breeders/Investment in Breeding**Number of Breeders**

There have been some crops for which a notable change has been observed in the number of breeders.

As shown in Fig. 4, a sharp increase in the number of rose breeders was observed in 1996. In that year, the number of companies increased from one to 13 and four "new" individual breeders also appeared.

Fig. 5 shows a similar development in the rice-breeding sector where the number of breeders has increased in various institutions such as private companies, universities and government research stations.

Fig. 4 Number of Rose Breeders

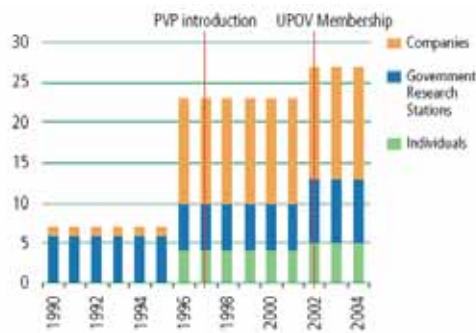
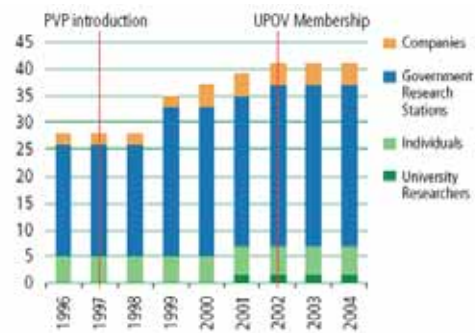


Fig. 5 Number of Rice Breeders



Since the introduction of the PVP system in the Republic of Korea, the number of applications from the private sector has increased continuously (see Figs 6 and 7). In the public sector, the number of applications by central government has been relatively stable, but the number of those by local governments is increasing (see Figs 8 and 9). The increase in the number of applications by local governments is related to investment for the breeders of new varieties, developed for their local farmers.

Fig. 6 Number of Applications by Domestic Individual Breeders

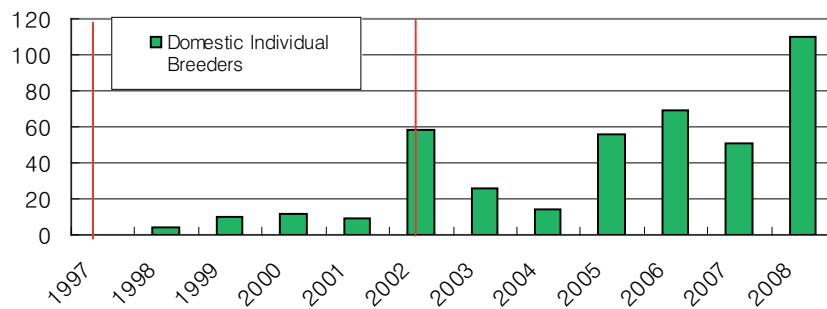


Fig. 7 Number of Applications by Domestic Seed Companies

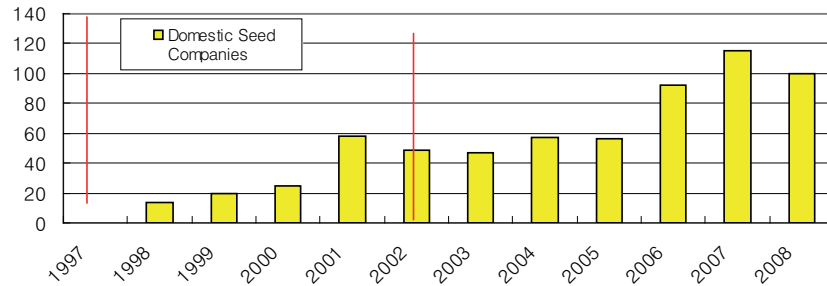


Fig. 8 Number of Applications by Domestic Local Governments

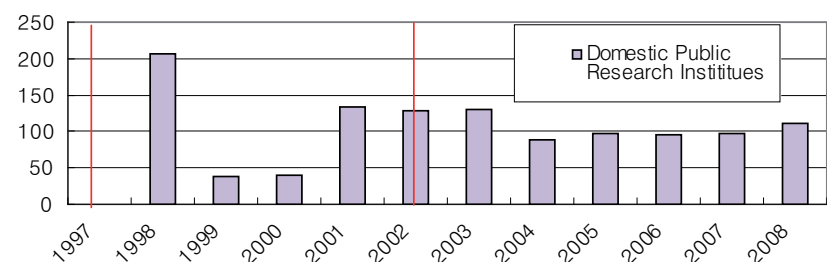
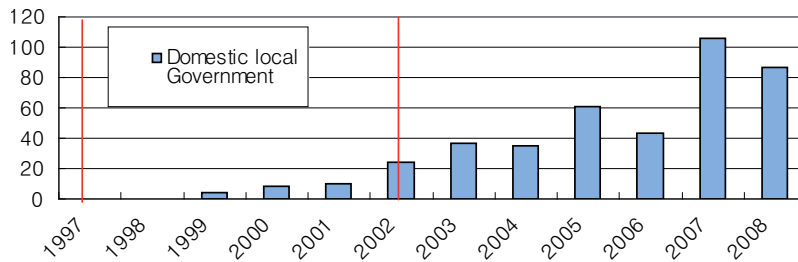


Fig. 9 Number of Applications by Domestic Central Government**Table 11 Number of Individual Breeders by Crop (May 2009)**

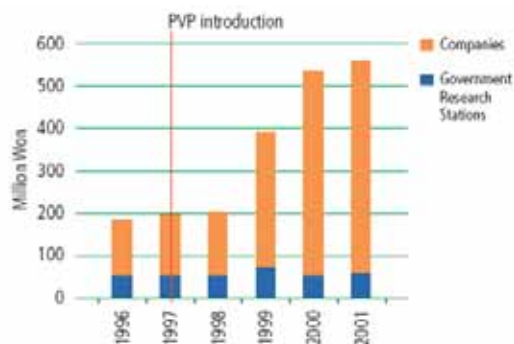
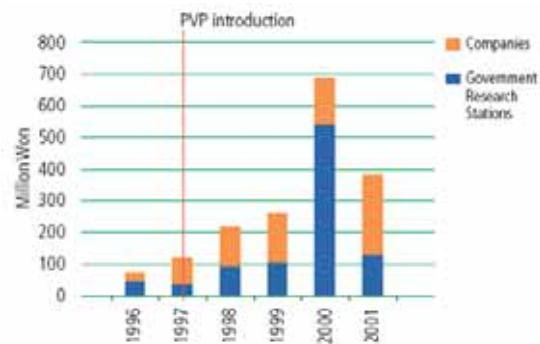
Total	Agricultural crops	Fruit	Flowers	Vegetables	Mushrooms	Industrial crops
445	24	64	188	85	66	17

Table 11 shows the number of individual breeders by crop. The introduction of PVP and other government incentives for breeders was associated with an increase in the number of individual breeders. This policy encouraged many potential breeders and growers, who were not previously actively involved in breeding, to take an interest in active breeding work.

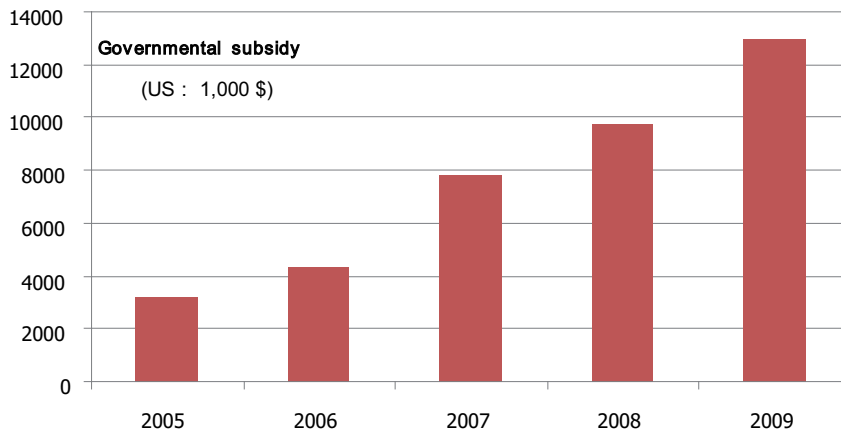
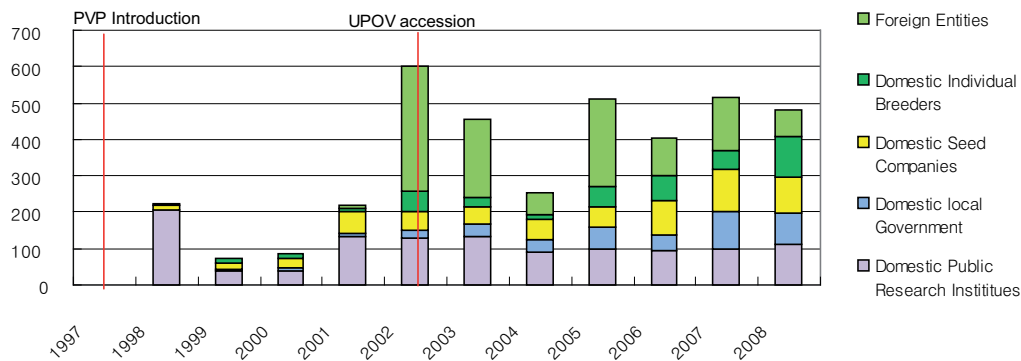
Investment in Breeding

Fig. 10 demonstrates that investment by companies breeding Chinese cabbage increased considerably in 1999 and 2000, after the introduction of PVP. The much lower level of investment by the government research stations has remained relatively stable.

The domestic breeding of roses was first started in government research stations in 1991 and was later followed by private companies. As shown in Fig. 11, investment by rose-breeding companies has increased steadily since the introduction of PVP. Government research stations have also increased their investment, with a significant peak in 2000, reflecting substantial investment in infrastructure for rose breeding, such as new greenhouses and breeding fields.

Fig. 10 Breeding Investment-Chinese Cabbage**Fig. 11 Breeding Investment-Rose**

The Agricultural Research and Development Promotion Project is a scheme that provides matching funds for private investment, from 50 per cent to 75 per cent of the research cost, in agricultural technology research. As such, it is an indicator of the level of investment by the private sector. The project started in 1995, but breeders had difficulty in using the fund until 2004, because support was mainly focused on new technology for agriculture rather than new varieties. In 2006, the Government changed some of the criteria to support R&D and simplified the administrative procedures for breeders to use the fund. Fig. 12 shows the trend of investment by R&D matching funds for breeding new varieties.

Fig. 12 R&D Matching Fund Investment for Breeding New Varieties*(iii) Structure of the Breeding Industry***Fig. 13 Number of Applications by Category**

The number of applications by category between 1998 and 2008 is provided in Fig. 13. The domestic central government category includes public research institutes, such as the National Institute of Crop Science (NICS), and the National Institute of Horticultural and Herbal Science (NIHHS). The domestic local government category includes the provincial crop stations. Foreign entities made a large number of applications after 2002 in particular for ornamental species.

The introduction of the PVP system encouraged many people to take an interest in breeding and, in the early stages, encouraged domestic PVP applications for most crops and foreign applications for ornamental crops.

Domestic seed companies have been mainly dependent on their own breeding programs or, in some cases, have cooperated with individual breeders. Since the introduction of the PVP system in the Republic of Korea, many university researchers have become interested in breeding commercial varieties (see Box 2, Rice "Sunong 6", "Sunong 8"). Also, for some crops, farmers (farmer-breeders) have shown an interest in breeding (see Box 10. Rice "Keumsung", Box 11, Lily "Dusan").

Box 10

Geumsung: Rice variety developed by a domestic individual breeder and granted protection in 2002

Box 11

Individual breeder KIM Yeong Hae (right)



Individual breeder AN Jae Yeong who bred lily variety "Dusan" which is PVP-registered and which won the Korean Top Variety Award in 2008.

The PVP system has encouraged local governmental research stations, universities and the Korean Atomic Energy Research Institute (KAERI, see Box 12) and KT&G (Korea Tobacco & Ginseng Corporation, see Box 5) to enhance their own breeding programs and distribution channels and new breeding segments have appeared. They are focusing on the niche market with the breeding of improved varieties with value-added traits. The availability of new, improved varieties has helped farmers to meet the increasing demand by consumers.

Box 12 Korea Atomic Energy Research Institute

Green Rice: "Nogwonchalbyeo"

"Nogwonchalbyeo" is a new, glutinous, green-kerneled rice (*Oryza sativa* L.) cultivar developed from native green-kerneled rice irradiated with 200Gy gamma rays. Compared to the original cultivar, "Nogwonchalbyeo" showed higher ripened grain ratio, early maturing characteristics, lodging tolerance and high yield (about 5.0 MT/ha in hulled grain rice). It also contains a higher amino-acid content than other conventional cultivars.



Ggoma (Hibiscus syriacu: Dwarf type cultivar "Ggoma" for potting culture and bonsai).

Government and public research institutes play an important role in the domestic breeding of fruit, ornamental crops and industrial crops.

(c) *Foreign Investment/International Dimension*

(i) *Introduction of Foreign Varieties*

Table 12 shows the development of the number of applications by non-residents (foreign breeders). It indicates a strong interest by foreign breeders in introducing their varieties into the Republic of Korea. Most of the varieties introduced by foreign breeders are ornamentals and their introduction coincides with the accession of the Republic of Korea to UPOV and the emergence of the flower business in the Republic of Korea.

Table 12 Number of Applications by Non-Residents by Crop (Top 10 Crops, 1998–2008)

	<i>Crops</i>	<i>No.</i>
1	Rose	487
2	Chrysanthemum	197
3	Kalanchoe	89
4	Gerbera	73
5	Anthrium	40
6	Carnation	36
7	Cymbidium	35
8	Impatiens	34
9	Pelargonium	30
10	Petunia	29
Total		1047
Total applications by non-residents		1169

Table 13 Number of Applications by Non-Residents by Crop (Top Five Crops)

	<i>Agricultural</i>		<i>Vegetables</i>		<i>Ornamental</i>	
	<i>Crops</i>	<i>No.</i>	<i>Crops</i>	<i>No.</i>	<i>Crops</i>	<i>No.</i>
1	Rice	1	Hot pepper	2	Rose	487
2	Soybean	1	Tomato	2	Chrysanthemum	197
3					Kalanchoe	89
4					Gerbera	70
5					Anthrium	40

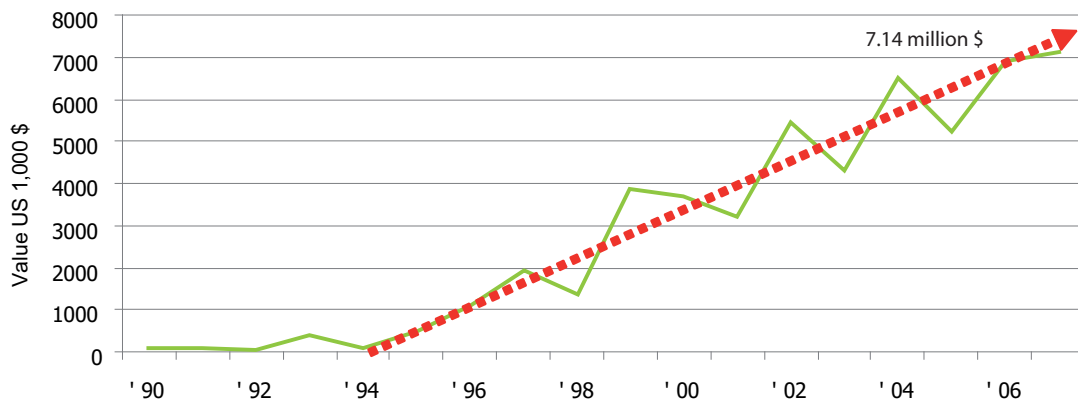
Table 14 Number of Applications by Country (Top 10 Countries, 1998–2008)

	<i>Country</i>	<i>No</i>
1	Netherlands	455
2	Japan	387
3	Germany	118
4	United States of America	65
5	Denmark	57
6	Italy	54
7	Israel	11
8	New Zealand	5
9	Spain	5
10	France	4
Total		1,161
Total applications by non-residents		1,169

(ii) *Development of Foreign Markets*

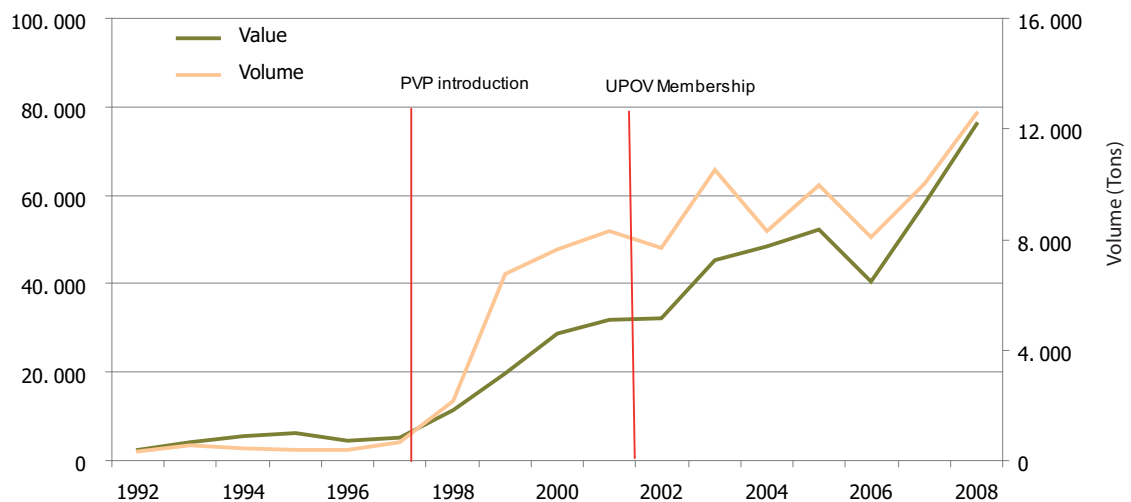
As shown in Fig. 13, the export of red hot pepper seed has increased consistently since 1995. There were competitive vegetable breeders even before the introduction of PVP and they were strong advocates of PVP. The introduction of PVP has accelerated the development of new varieties and led to an increase in the export of seed.

Fig. 13 Export of Red Hot Pepper Seed



The export of flowers and ornamental plants has been increasing since the late 1990s, coinciding with the introduction of PVP, which has supported an increase in the export of flowers and ornamental plants.

Fig. 14 Export of Flowers and Ornamental Plants (1000 US\$ per Ton)



(iii) Breeder’s Exemption

The UPOV system of PVP allows the use of protected varieties for breeding other varieties under the principle of the breeder’s exemption. For example, protected foreign rose varieties may be used by breeders for further breeding purposes. In the case of the Republic of Korea, the increased investment in rose breeding, implied through the increased number of rose breeders and the increased rose germplasm resulting from the introduction of foreign rose varieties, should strengthen the rose-breeding sector in the country (see Box 13).

Box 13



“Ruigerdan” (Little Marble)
Developed in the Netherlands



“Little Sun” (Bright red variety)
Rural Development Administration
Developed at the Kyungnam Provincial
Crossing of: Nikida x Little Marble

Korean rose variety “Little Sun”, granted protection in 2006, was bred using the protected variety “Ruigerdan” (Little Marble), developed in the Netherlands

(d) Summary

The introduction of PVP in the Republic of Korea in 1997 and membership of UPOV in 2002 have had a significant influence on the seed and breeding industries.

Although it is still premature to evaluate the full impact, the following effects have been observed.

- ▶ Introduction of PVP resulted in a large number of new varieties by residents. Membership of UPOV was associated with a large number of new varieties by non-residents, particularly in the ornamental sector.
- ▶ An instant response to the extension of the range of genera and species covered by PVP could be observed by the sharp increase in the number of PVP right applications in ornamental crops in July 2001.
- ▶ New, improved varieties have been produced for various agricultural and horticultural crops, including traditional crops (e.g. ginseng).
- ▶ Introduction of new foreign varieties, especially ornamental varieties such as roses, have contributed to the flower industry of the Republic of Korea, one of the fastest developing sectors of agriculture in the country; introduced varieties have been used by domestic breeders for further breeding; the PVP system has also supported the export of flowers and ornamental crops.
- ▶ There is a continuous increase in the number of applications from the private sector and local governments, but the number of applications by central government is relatively stable.
- ▶ The PVP system has stimulated certain sectors in plant breeding: in the sector of ornamental breeding, new breeders have appeared and the number of domestic varieties has increased; in the sector of vegetable breeding, private companies have continued their major roles in breeding for domestic distribution or seed export.

6. Conclusions

We have seen the experience of the Republic of Korea in meeting several challenges by encouraging plant breeding through the introduction of PVP and accession to the UPOV Convention.

After the introduction of the PVP system and accession to the UPOV Convention, breeders could work more effectively and there has been development in the breeding industry. The Government of the Republic of Korea also considers the breeding industry as a key sector of agriculture and has been promoting investment by an R&D matching fund, etc.

As a result of breeding, there has been improvement of varieties; farmers have access to better varieties.

As shown in the export of red hot pepper seed, cut flowers and ornamental plants, PVP has facilitated export by improvement of varieties or supported it.

ANNEX NUMBER OF GENERA AND SPECIES DESIGNATED TO BE ENTITLED TO PROTECTION.

<i>Eligible for protection since</i>	<i>Genera and species</i>
December 31, 1997 (27 genera/species)	<ul style="list-style-type: none"> ▪ Food Crops (6): Rice, Barley, Soybean, Maize, Potato, Wheat ▪ Vegetables (14): Radish, Chinese cabbage, Cabbage, Pepper, Tomato, Cucumber, Oriental melon, Water melon, Squash, Welsh onion, Onion, Carrot, Lettuce, Spinach ▪ Fruit (3): Apple, Pear, Peach ▪ Ornamentals (1): Plain cactus ▪ Feed crops (3): Rye grass, Tallfescue, Red clover
May 1, 2000 (30)	<ul style="list-style-type: none"> ▪ Food Crops (2): Oats, Sweet potato ▪ Vegetables (2): Melon, Cauliflower ▪ Fruit (2): Grapevine, Yuzu (Citrus) ▪ Ornamentals (15): Forsythia, Hibiscus, Lycoris, <i>Ajuga multiflora</i>, <i>Lisianthus</i>, Petunia, Godetia, Impatiens, Cyclamen, Snapdragon, Pansy, Daisy, Alstromeria, Hyacinth ▪ Industrial crops (7): Sesame, Perilla, Ground nut, Rape, <i>Angelica gigas</i>, <i>Astragalus membranaceus</i>, Mushroom (Pleurotus spp.) ▪ Feed crops and others (2): Orchard grass, Ginseng
July 1, 2001 (31)	<ul style="list-style-type: none"> ▪ Ornamentals (21): Dendrobium, <i>Aerides japonicum</i>, <i>Neofinetia falcata</i>, Calanthe discolor, Rose, Lily, Chrysanthemum, Iris, Gladiolus, Tulip, Poinsettia, Celosia, Stock, Zinnia, Forget-me-not, Cineraria, Nasturtium, Pot marigold, Sweet alyssum, Ageratum, Day lily ▪ Industrial crops (10): <i>Rehmannia glutinosa</i>, Lycium, Dioscorea, <i>Bupleurum falcatum</i>, <i>Platycodon grandiflorum</i>, Cassia, <i>Liriope platyphylla</i>, <i>Anglica dahurica</i>, Saposhnikovia
July 1, 2002 (25)	<ul style="list-style-type: none"> ▪ Food Crops (4): Rye, Adzuki bean, Mungbean, Pea ▪ Vegetables (3): Egg plant, Pak choi, Gourd ▪ Fruit (1): Kiwi fruit ▪ Ornamentals (9): Kalanchoe, Cattleya, <i>Oncidium</i>, Plantain lily, Canterbury bells, Geranium, Bird-of-paradise, Tree peony, <i>Chamaecereus silvestrii</i> ▪ Industrial crops (8): Ganoderma, <i>Angelica koreana</i>, <i>Pleuropterus multiflorus</i>, Alisma, <i>Scutellaria baicalensis</i>, Chinese peony, Carthamus tinctorius, Lance Asia bess
December 1, 2004 (42)	<ul style="list-style-type: none"> ▪ Food Crops (2): Kidney bean, Job's tears ▪ Vegetables (4): Mustard, Turnip rape, Kohlrabi, Edible chrysanthemum ▪ Ornamentals (31): Dahlia, Allium, Fritillary, Gloxinia, Common calla, Blue grape hyacinth, <i>Ornithogalum</i>, <i>Anthurium</i>, Crocus, Amaryllis, Royal azalea, Common camellia, Hydrangea, Carnation, Gerbera, Gypsophila, Kaffir lily, Sea lavender, Begonia, Bachelor's button, Moth orchid, Aquilegia, <i>Campanula punctata</i>, <i>Campanula takesimana</i>, Rough gentian, Gentiana, Aster, Spring orchid, Winter orchid, Chinese pink, Freesia ▪ Industrial crops (5): <i>Schizandra</i>, <i>Angelica</i>, Atractylis, Cnidium, mushroom (<i>Phellinus</i> spp.)
December 1, 2006 (34)	<ul style="list-style-type: none"> ▪ Food Crops (2): Buckwheat, Triticale ▪ Vegetables (7): Chinese chive, Kale, Leaf beet, Whorled mallow, Chicory, Endive ▪ Ornamentals (17): Thistle, Delphinium, Phlox, Indian rubber tree, <i>Dracaena fragrans</i>, Philodendron, Tillandsia, Cymbidium, Anemone, Clematis, Lantana, Gay-feather, Desert rose, Maidenhair fern, Osmunda, <i>Dracaena</i>, Peperomia, Indian fig cactus ▪ Industrial and Feed crops (8): Fatsia, Codonopsis, Cyperus, Common Anemarrhena, Gardenia, Entomopathogenic fungi, Hawthornleaf raspberry, Alfalfa
March 1, 2008 (34)	<ul style="list-style-type: none"> ▪ Food Crops (3): Italian millet, Common millet, Sorghum ▪ Vegetables (3): Celery, Parsley, <i>Brassica rapa</i> L. ▪ Ornamentals (9): <i>Hedyotis diffusa</i> Willd., <i>Euphorbia hypericifolia</i>, Alocasia, Exacum, <i>Aster koraiensis</i> Nakai, Gaura, Tickseed, <i>Sedum kamtschaticum</i>, <i>Carex okamotoi</i>, ▪ Industrial crops (5): Chinese licorice, Eucommia (Gutta-percha tree), Asiatic dogwood (Japanese cornel, Japanese corneliancherry), <i>Gastrodia elata</i> Blume, Japanese mugwort ▪ Mushrooms (3): <i>Agaricus bisporus</i> Sing, Winter mushroom (Enokitake, Velvet footed Collybia), Shiitake ▪ Trees (11): Persimmon, Japanese plum, Apricot, Mume (Japanese Apricot), <i>Mukdenia rossii</i>, Chestnut, Zelkova, Hill cherry (Japanese mountain cherry), ACER PALMATUM Thunb. ex Murray, Jujube, Tobacco
May 1, 2009	All Species and Genera except for Strawberry, Raspberry, Blueberry, Mandarin, Cherry and Seaweed

DISCUSSION

EUNICE OMBACHI (KENYA SEED COMPANY LTD., KENYA): I didn't really understand whether you have an organization that is in charge of plant variety rights. Secondly, do you have a body that arbitrates if there is a contest about somebody wanting to protect a variety that is really close to an existing variety? How do you arbitrate?

CHANG HYUN KIM: There are two PVP offices in the Republic of Korea that are responsible for plant breeders' rights. Regarding agricultural plants, the Korea Seed and Variety Service (KSVS) is responsible for plant breeders' rights. With regard to arbitration, the Government strongly encourages parties to go to arbitration before they start a judicial procedure. However, if they cannot resolve the situation by arbitration, they must go through the judicial procedure.

PATRICK NGWEDIAGI (MINISTRY OF FOOD SECURITY AND COOPERATIVES, UNITED REPUBLIC OF TANZANIA): I am very impressed by the efforts of your Government to encourage breeding. So I would like you to shed more light on the efforts of the Government, especially on this system of giving awards to breeders.

DOUG WATERHOUSE: We all share your positive view of giving awards to breeders. Now we can move towards the general discussion on this topic.

GENERAL DISCUSSION

MANOJ SRIVASTAVA, PPV AND FR AUTHORITY, MINISTRY OF AGRICULTURE, GOVERNMENT OF INDIA The farmer plays an important role in conserving the plant genetic resources. Do we give any privileges or benefit to the farmers who have developed this material for so long by tradition, because that material is used by the breeders in various countries for developing new varieties?

ROLF JÖRDENS: The advantage and the objective of the system are, of course, to provide farmers and growers with more and better varieties. A farmer's privilege, as such, does not exist in the UPOV Convention. We have a number of exceptions and I think Peter Button explained these compulsory exceptions; in particular, the exception which allows the use of the protected variety for private and non-commercial purposes, and that concerns subsistence farmers – as long as their activities are private and non-commercial. That is a compulsory exception in the UPOV Convention, which perhaps concerns more than 50 per cent of the farmers in many developing countries. So they would not be subject to any restriction and could use a protected variety for private and non-commercial purposes. Then there is the optional exception, which means that a UPOV member may restrict the scope of the breeder's right in order to allow farmers to reproduce a variety from the harvest of a protected variety on their own farm or holding. This optional exception allows many different forms of restricting or limiting the breeder's right, according to specific circumstances in a particular country. It is very difficult to summarize this here, but there are many possibilities and examples of how UPOV members have made use of this optional exception. As I think we stressed here, we should not forget that the objective is of course to encourage breeding, to encourage the introduction of new and better varieties – that is the objective and here governments need to be very cautious not to undermine, or to forget, the overall objective of the system. I think that is what we need to keep in mind.

FRANÇOIS BURGAUD (GNIS, FRANCE): I would like to go back to the remark of the representative of Syngenta about the position of Plantum, because I am not totally sure that the answer of Plantum is a 100 per cent good answer, but I am quite sure that it is a good question. It is a good question for two main reasons: firstly, some patent claims from seed and biotech companies are not reasonable and, secondly, the policies of patent officers indicate a misunderstanding about plant-breeding activities. The representative of Syngenta talked about balance. I see clearly in UPOV and plant breeders' rights the balance between an exclusive right on production and sale and free access for further breeding activity, so I would like to know what is the second part of the balance in the patents on biotech inventions.

LEO MELCHERS (SYNGENTA SEEDS B.V., NETHERLANDS): The purpose of patenting of biotechnological inventions is very different from plant breeders' rights. We are talking about molecular breeding, investments which have been made by the breeder, high investments, to discover novel traits and we are talking about a system of rewarding the plant innovator, the innovator of traits. It is not about blocking access, it's about using the patent system, which has a role in the seed industry. Parties can get access to licenses and use these traits in their breeding program and that is where we look for a balanced approach in terms of value-sharing between the innovator, the licensee and also, definitely, the farmer who will benefit from the innovation and will have better crops to grow, and will also have a higher income from using improved varieties.

DOUG WATERHOUSE: One of the issues that we didn't air today, of which François has just reminded me, was a key factor in the UPOV system, and that is about certainty. One of the very nice things is the idea of exhaustion. Instead of having an implied exhaustion as for some other rights, the UPOV system has an explicit and total exhaustion once the breeder has sold material or material has been sold with his consent, provided some other particular circumstances don't arise further on. So that is another part of the balance, once material is sold to the farmer, then the plant breeder's right is completely exhausted.

ANTON VAN DOORNALEN (RIJK ZWAAN ZAADTEELT EN ZAADHANDEL B.V, NETHERLANDS/MEMBER OF THE BOARD OF PLANTUM NL): I would like to say that Plantum very much supports the PVP system and especially the breeder's exemption. We would like here, especially, to underline that we are not against

patents. We see that patents are a very good means to protect breeding matters and technologies. However, we see that more and more traits are patented, and we are of the opinion that when a patented trait is in a new variety, or when a variety is made by a patented technique or method, then that variety should be protected by a plant breeder's right and should have full breeder's exemption; the full breeder's exemption should be applicable, which means that the whole variety, with all its characteristics should be freely available for all breeders. In other words, if we accept that one patented trait is indirectly patenting the variety, the breeder's exemption becomes worthless, and, with that, the plant variety protection system. That is what we are discussing and that is, in fact, the new standpoint of Plantum.

LUCA COLOMBO (GENETIC RIGHTS FOUNDATION, ITALY): I am interested in understanding the evolution of the UPOV system, if any, in the near future, with particular reference to the exceptions – both currently compulsory and optional.

ROLF JÖRDENS: We expect further growth in UPOV membership: on average, UPOV has seen three new members per year. So that is what I see in the first place as an evolution of the UPOV system. I think your question concerns the UPOV Convention and I think it is a question which should be addressed to the President of the Council of UPOV. Of course the UPOV Office follows this matter and I can only say for the moment, and I think the President can probably confirm, that there is no indication that UPOV members have taken any initiative with regard to revision of the 1991 Act of the UPOV Convention.

DOUG WATERHOUSE: That is correct. There have been no instructions from the Council in relation to any developments in the Convention.

JOHN HAMPTON (BIO-PROTECTION RESEARCH CENTRE, NEW ZEALAND): When Peter answered the question before about distinctness, he more or less implied that you were looking at morphological characteristics. How do you address a situation where the distinctness is due to the presence of a microbe in association with the plant, for example, a fungal endophyte?

PETER BUTTON: I think we have to be a little bit careful that we split that up because there are two issues: firstly, to do with plant variety in a traditional plant variety sense, but you also seem to be talking about the fungal endophyte itself as potentially covered by the UPOV Convention - the definition of plant can be broad in the UPOV Convention and whether fungi, bacteria, algae and so on are covered by the UPOV Convention is a matter for each UPOV member to consider. You can then look at the fungal endophyte in its own right if you decide to offer protection for that. However, if you are looking at the plant, ignoring the endophyte for a moment, then it is the plant variety that has to be distinct. It cannot be considered as a different plant variety because you have infected it with a disease or an organism; that doesn't make it a different plant variety. There are some difficult situations where, for example, organisms such as phytoplasma can have an influence on the plant and you have to be very careful to check if the difference is in the plant variety and not an infection that has taken place. You can also consider protecting fungal endophytes. Certainly I know that some UPOV members are looking very closely at that. That must be separated from looking at the "traditional green plant" where we must be careful to check if we are looking at a different variety rather than the same variety which looks different because it is infected by an organism.

TRUDY WERRY (CANADIAN FOOD INSPECTION AGENCY, CANADA): My question is also on the criteria of distinctness in relation to a plant breeder's right. Is distinctness only based on phenotype, or is UPOV moving towards molecular techniques? What happens if molecular techniques are used to show distinctness in crops, such as potatoes where it is very hard to see any difference from variety to variety, even though they are different?

PETER BUTTON: This is another area where there is a lot of discussion within UPOV – the potential use of molecular techniques in the DUS examination. I think the first thing to say, and probably we always start with this, is that at the moment we have a very effective and efficient system of DUS examination. It works very well and is a very cost-effective system. So we are not under urgent pressure to introduce new techniques to solve a problem. However, there are new techniques, and potentially they can assist in the DUS examination. At the same time, a major concern of breeders, which has been communicated to UPOV, is that if you use these techniques to find very, very small differences

between varieties, potentially down to just one base pair, there is a risk of undermining the value of protection. Potentially, the result could be a very large number of essentially derived varieties, differing only by one base pair. Nevertheless, there are ways in which molecular techniques might have potential to make the system more efficient. Those are under discussion in UPOV. Already there are some approaches that have been agreed. For example, a test for a molecular marker reliably indicating the presence of a phenotypic expression - for example, a particular disease-resistance - could be used instead of the phenotypic test. There you are not really changing the DUS criteria, but you are making the test more efficient – you are checking to see whether the gene is there. There are also broader approaches for using molecular markers to screen the varieties of common knowledge to try to help to ensure that we identify the most similar varieties and to ensure that they are included in the DUS growing trial, but this is quite a complex area and, again, it needs some safeguards built into it. We have some documents that explain where we are on all of this. It is an area that we are looking at, but I think what everyone is very concerned about is that we don't lose the value of the current system of plant variety protection, nor its effectiveness. We don't want to just switch over to a new system for no benefit and potentially to undermine the value of protection that we have already.

NICK DOWNEY (EUROPEAN MOBILE SEED PROCESSORS ASSOCIATION): Did I understand from the earlier question of my colleague that the optional farm-saved seed exemption in Europe is not under review?

DOUG WATERHOUSE: We have the President of the Community Plant Variety Office of the European Community (CPVO), Mr. Bart Kiewiet, with us. Perhaps he could answer that.

BART KIEWIET (COMMUNITY PLANT VARIETY OFFICE OF THE EUROPEAN COMMUNITY (CPVO)): At the moment, there is no official review of the farm-saved seed provision in the framework of the Community plant variety system. There has been a study initiated by the CPVO to try to have a picture of the present situation and to try to clarify whether the present provision is effective and whether it serves its aims. We are in the process of further studying the situation and it might lead to proposals of a revision of the actual provision as regards farm-saved seed. But, at the moment, an official review is not taking place. We are in the phase before an official review.

Session 3. Conclusion, presented by the Chairperson Plant Variety Protection

- ▶ The number of new varieties increased after the introduction of plant variety protection.
- ▶ Introduction of the UPOV system of plant variety protection was associated with increased breeding activity and with the encouragement of new types of breeders, such as private breeders, researchers and farmer-breeders. The introduction of PVP was also associated with the development of partnerships, including public-private cooperation.
- ▶ Introduction of plant variety protection was associated with the development of new, protected varieties that provided improvements for farmers, growers, industry and consumers, with overall economic benefits.
- ▶ One of the benefits of plant variety protection is to encourage the development of new, improved plant varieties that lead to improved competitiveness in foreign markets and to development of the rural economy.
- ▶ Membership of UPOV was associated with an increase in the number of varieties introduced by foreign breeders, particularly in the ornamental sector.
- ▶ The breeder's exemption, whereby protected plant varieties can be freely used for further plant breeding, is an important feature of the UPOV system which advances progress in plant breeding.
- ▶ Access to foreign plant varieties is an important form of technology transfer that can also lead to enhanced domestic breeding programs.