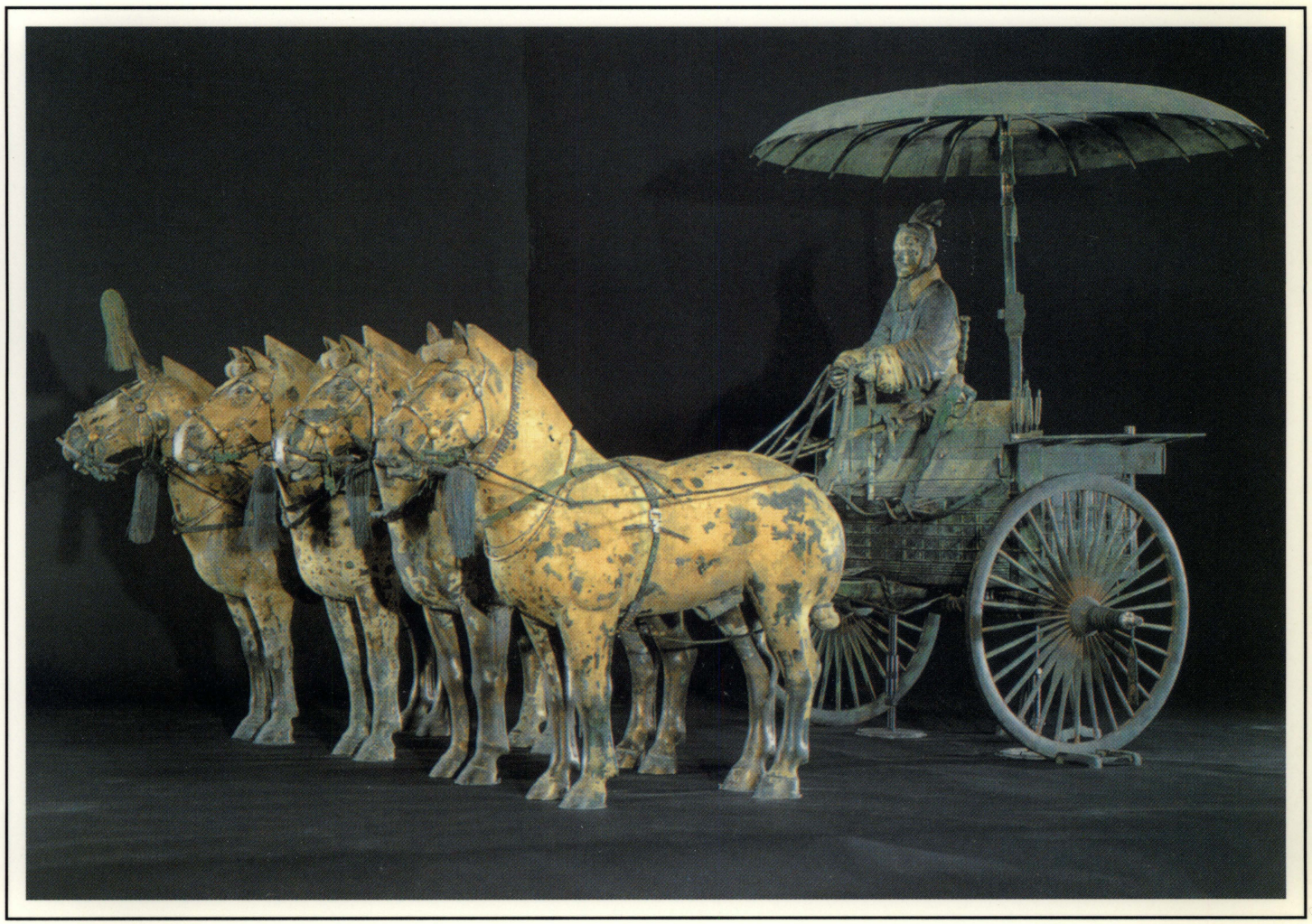
SEMINAR ON THE NATURE OF AND RATIONALE FOR THE PROTECTION OF PLANT VARIETIES UNDER THE UPOV CONVENTION

BEIJING, CHINA
September 15 to 17, 1993



UPOV

SEMINAR ON THE NATURE OF AND RATIONALE FOR THE PROTECTION OF PLANT VARIETIES UNDER THE UPOV CONVENTION

organized by
the International Union for the Protection of New Varieties of Plants
in cooperation with
the State Science and Technology Commission of China (SSTCC)
and with the assistance of
the Japanese Ministry of Agriculture,
Forestry and Fisheries (MAFF)

Beijing, China, September 15 to 17, 1993

UPOV

Geneva
1994

UPOV PUBLICATION
No. 730 (E)

ISBN: 92-805-0527-0

Cover: No.1 Bronze Chariot with Draught Horse from the Qin Shi Huang Mausoleum, Xian, China (Photograph by Guo Youmin).

FOREWORD

The International Union for the Protection of New Varieties of Plants (UPOV), in cooperation with the State Science and Technology Commission of China and with the assistance of the Japanese Ministry of Agriculture, Forestry and Fisheries, organized a Regional Seminar on the Nature of and Rationale for the Protection of Plant Varieties under the UPOV Convention, which was held in Beijing, China, from September 15 to 17, 1993.

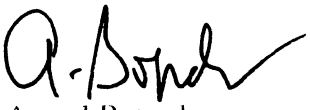
The Seminar was attended by government officials in charge of seed and variety regulations or related matters of the following Asian countries: Bangladesh, China, India, Indonesia, Malaysia, Pakistan, Philippines, Republic of Korea, and Thailand. During the Seminar presentations were made by a number of distinguished experts on various aspects of plant variety protection.

The Seminar was the third of its kind in Asia and offered participants an opportunity to know more about plant variety protection under the UPOV Convention.

The Seminar also provided the opportunity to visit various research centers of the Chinese Academy of Agricultural Sciences, including the Germplasm Bank, the Biotechnology Center, the Crop Breeding and Cultivation Institute and the Vegetable and Flower Research Institute.

This publication contains the texts of the presentations given by the speakers and the representatives of the participating countries.

UPOV takes this opportunity to express its thanks to the Chinese Government, in particular the State Science and Technology Commission of China, for its excellent assistance in the organization of this Seminar. UPOV also thanks the Japanese Ministry of Agriculture, Forestry and Fisheries for its financial support for the Seminar.



Arpad Bogsch
Secretary-General
International Union for the Protection
of New Varieties of Plants

Geneva, July 1994

TABLE OF CONTENTS

The Current Situation of the Plant Breeding and Seed industries in the Asian and Pacific Region; the Policy on the Protection of New Varieties

OPENING ADDRESS

by

Dr. Arpad Bogsch, Secretary-General of UPOV

Mr. Hui Yongzheng, Vice-Presicent of the State Science and Technology Commission,
Mr. Hong Fuzeng, Vice-Minister of the Ministry of Agriculture,
Mr. Zhu Guangyao, Vice-Minister of the Ministry of Forestry,
Mr. Wang Lianzheng, President of the Chinese Academy of Agricultural Sciences,
Mr. Xu Zhihong, Vice-President of the Chinese Academy of Sciences,
Mr. Ma Lianyuan, Vice-Director of the Chinese Patent Office,
Ladies and Gentlemen,

It is a well-known fact that plants are directly or indirectly the basis for all the food that humans and animals need and consume.

The discovery or the creation of new varieties of plants is most desirable. The population of the Earth is expected to double within 25 to 30 years. Double the present amount of food will be needed, and even more than double, since one should also eliminate the undernutrition wherever it exists in the world.

At the same time, the surface of the land available for growing plants will probably diminish because more space is needed for more people and because of increased pollution.

All this makes it necessary that plants should have an increased yield of improved quality, should better resist plant diseases and should need less chemical fertilizers.

The aims of plant breeding are just these: a greater yield of improved quality and more resistances, whilst respecting the need for increased protection of the environment.

The production of new plant varieties requires imagination, scientific research, patient testing and, of course, investment.

In order to encourage breeding of more new plant varieties, one has to create a legal system in which the use of the new varieties--by third persons--requires the breeder's authorization. This right, by its nature, is similar to the right of an inventor who has patented his invention, or to the right of an author who has created a literary, musical, artistic or other work. The right of authorization being accorded for money, the inventor, author or plant breeder are rewarded and encouraged.

The present Regional Seminar will be an exchange of information on what kinds of protection exist internationally for new plant varieties, what are the existing solutions on the national level, particularly in South-East Asia, and in what ways one could and should create or improve the protection of the rights of plant breeders in their new varieties of plants.

The Seminar will, in particular, focus on the protection available under the Conventions--the multilateral treaties--of the International Union for the Protection of New Varieties of Plants (UPOV).

UPOV has existed for more than 30 years and has 24 member States. Its Secretariat is in Geneva. The head of its Secretariat is the same person who is the head of the Secretariat of the World Intellectual Property Organization (WIPO). But for this and other administrative cooperation, WIPO and UPOV are independent from each other, and the Vice Secretary-General, at the present time Mr. Barry Greengrass, an Englishman, is always a specialist in plant breeders' rights.

The present Regional Seminar is organized by UPOV in cooperation with the State Science and Technology Commission of China. The Ministry of Agriculture of China also participates in the organization, while financial assistance has been given by the Ministry of Agriculture, Forestry and Fisheries of Japan; assistance which helps participation from outside China.

I wish to thank the Chinese authorities for inviting the Seminar to Beijing and for having excellently organized our work and our stay. And I thank the Japanese Government for its generous contribution.

Finally, I wish to express, towards our Chinese hosts, the deep appreciation of all foreign participants and of UPOV for their warm hospitality which we enjoy today and shall enjoy during our whole stay in China.

WELCOME ADDRESS

by

Mr. Hui Yongzheng, Vice-President,
State Science and Technology Commission of China

Distinguished Guests,
Ladies and Gentlemen,

The Regional Seminar for Asia and the Pacific of the International Union for the Protection of New Varieties of Plants is held today in Beijing. On behalf of the State Science and Technology Commission, I should like to express our warm congratulations on the Seminar and to warmly welcome Dr. Bogsch, Director General of the World Intellectual Property Organization and concurrent Secretary-General of the International Union for the Protection of New Varieties of Plants, who has made a special trip to attend this conference, and Mr. Greengrass, Vice Secretary-General of the International Union for the Protection of New Varieties of Plants, and specialists and representatives from all countries.

According to the statistics of the Food and Agriculture Organization of the United Nations (FAO), the grain output of the world has doubled in the recent 25 years. This should be attributed, to a great extent, to the use of improved varieties. So the work of protecting plant varieties has received more and more widespread attention and been attached importance by all countries of the world. The International Union for the Protection of New Varieties of Plants is an intergovernmental organization; its aim is to coordinate with each member country on the policies, regulations and their implementation in the protection of new plant varieties, and to organize member countries to make evaluation and classification on new plant varieties for protection. It has made an active contribution to the protection of new plant varieties. As a big country in agriculture, China has paid great attention to the research on the protection of new plant varieties, and has made impressive achievements in developing new plant varieties, and important contributions to basically solving the problem of food and clothing for 1.1 billion people as well as to the development of world agriculture.

Today we meet here in order to understand the Organization, its relevant policies and regulations, to exchange some basic methods and the experiences on the protection of new plant varieties, to promote the establishment and development of the protection of new plant varieties in China, to actively participate in the activities of the International Union for the Protection of New Varieties of Plants, and to conduct exchanges and cooperation with all countries of the world.

According to the requirements of the Uruguay Round of the General Agreement on Tariffs and Trade, the protection of intellectual property on seed will be put into practice within ten years. As China is applying for resumption of its status as a contracting party to GATT, it is only natural and necessary that China keeps in conformity with the international practice of intellectual property protection. Through the exchanges at the Seminar, more foreign guests will be able to understand the work and the present situation on the protection of new plant varieties in China, which will speed up the development of exchanges and cooperation between China and the countries in the world on the protection of new plant varieties, facilitate the legislative process on the protection of new plant varieties in China, and increase the

friendship with the people of countries all over the world. This is the major purpose of this Seminar. I do believe that through the Seminar, the work of protecting new plant varieties will be surely pushed to a climax. Meanwhile, it will also further improve our understanding on the protec- tion of new plant varieties. Please speak out freely and air your own views, consult and exchange with each other.

The early autumn in Beijing is nice and cool, the scenes are especially beautiful. I wish all the friends here to work smoothly and have a pleasant stay in Beijing.

May the Conference be a complete success. Thank you!

F I R S T S E S S I O N

GENERAL INFORMATION ON THE UPOV SYSTEM OF PLANT VARIETY PROTECTION

WHAT IS PLANT VARIETY PROTECTION?

Speaker: Mr. Barry Greengrass, Vice Secretary-General of UPOV, Geneva, Switzerland

AN OVERVIEW OF PLANT VARIETY PROTECTION IN THE WORLD (THE DEVELOPMENT OF UPOV; THE FORM OF PROTECTION; IMPLEMENTATION AT THE NATIONAL LEVEL)

Speaker: Mr. Makoto Tabata, Office of UPOV, Geneva, Switzerland

Chairman: Mr. Song Zehou, Director General, Department of Rural Science and Technology, State Science and Technology Commission of China, Beijing, China

WHAT IS PLANT VARIETY PROTECTION?

1. This note serves as a guide in question and answer format to enable participants in the UPOV Seminar to gain some initial familiarity with the concept of plant variety protection.

What is plant variety protection?

2. Plant variety protection, also called a "plant breeder's right," is an exclusive right to exploit his variety granted to the breeder of a new plant variety. It is a form of intellectual property right, examples of other such rights being patents, copyrights, trademarks, and industrial designs.

3. Plant variety protection has certain features in common with patents for industrial inventions. Both forms of protection grant to their holders a form of exclusive right so as to provide an incentive to pursue innovative activity.

4. Plant variety protection may also be compared with copyright, as plant variety protection enables the reproduction (copying) of protected plant varieties to be constrained by the owner of the protected variety.

5. Plant variety protection is an independent sui generis form of protection tailored for the purpose of the protection of new plant varieties, having certain features in common with other intellectual property rights but having at the same time fundamental differences.

Why should new plant varieties be protected?

6. New varieties of plants giving a higher harvested yield or providing resistance to plant pests, diseases, etc. are an essential factor in increasing productivity and product quality in agriculture, horticulture and forestry.

7. Breeding new varieties of plants requires a substantial investment in terms of skill, labor, material resources, and money, and may take many years (10 to 15 years in the case of many plant species). A new variety, once released, may in many cases be readily reproduced by others so as to deprive its breeder of the opportunity to profit adequately from his investment.

8. Granting to a breeder of a new variety the exclusive right to exploit his variety both encourages him to invest in plant breeding and contributes to the development of agriculture, horticulture and forestry.

What is UPOV?

9. The International Union for the Protection of New Varieties of Plants, known as "UPOV," is an intergovernmental organization with headquarters in Geneva. The acronym UPOV is derived from the French name of the organization, which is "Union Internationale pour la Protection des Obtentions Végétales."

10. UPOV was established by the International Convention for the Protection of New Varieties of Plants, which was signed in Paris in 1961 and entered into force in 1968. The Convention was revised in Geneva in 1972, 1978 and 1991.

11. The member States have undertaken to grant plant breeders' rights in respect of new plant varieties in accordance with the principles established in the Convention and thus on an internationally harmonized basis.

12. Most of the member States are bound by the 1978 Act, adopted at the Diplomatic Conference held in that year. The 1978 Act was signed, but has not yet been ratified, by Mexico. Austria, Portugal and Ukraine have enacted new laws on plant variety protection, Argentina and Uruguay have revised their laws and Chile is revising its law so as to accord with the 1978 Act of the UPOV Convention. They are expected to become member States of UPOV in the near future. A number of other countries have laws currently before their legislature. Regional treaties concerning plant variety protection are under consideration by the member States of the Andean Pact, CONASUR (an organization for cooperation in agriculture of the States of the Southern "cone" of Latin America) and the EEC.

13. The 1978 Act is the Act of the UPOV Convention that is in force. In March 1991, a Diplomatic Conference was held in Geneva which resulted in the unanimous adoption by the member States of UPOV of a new revised 1991 Act of the UPOV Convention ("the 1991 Act"). This new 1991 Act will not come into force until five States have acceded to it. When it comes into force it will only bind States which have chosen to accede to it. Existing member States will only become bound by the 1991 Act when they have modified their existing laws and deposited an instrument of accession to the new Act. For the time being no member State has deposited such an instrument, but Morocco, Romania and the Russian Federation have laws or draft laws which accord with the 1991 Act and the regional proposals of the EEC and the Andean Pact also reflect the revision of 1991. The great majority of UPOV member States now have proposals to modify their laws at an advanced stage.

14. The initial content of this lecture is limited to the 1978 Act. This is the Act which binds all existing member States of UPOV, which is the basis of the existing UPOV system of plant variety protection and to which UPOV still expects a few new member States to adhere in the years immediately ahead. Finland and Norway, for example, which became member States of UPOV in 1993, did so on the basis of the 1978 Act. Table 1 shows the membership of UPOV at September 13, 1993.

What are the exclusive breeders' rights provided for in the 1978 Act of the UPOV Convention?

15. The breeder is granted the exclusive rights to produce for the purpose of commercial marketing, and to offer for sale and to market the propagating material of his variety. The right extends only to the propagating material of his variety and not to the harvested end product, for example the fruit from a protected variety of fruit tree. Since the exclusive right includes only production for commercial marketing, it does not extend to production of propagating material that is not for commercial marketing. Accordingly, production of seed, for example, by a farmer for subsequent sowing on his own farm, falls outside the breeder's protection.

16. In 1961, when the UPOV Convention came into being, the scope of the rights accorded to the breeder represented a careful balance between the interests of breeders of new varieties on the one hand and the interests of users of new varieties (farmers and consumers) on the other hand.

Table 1: Membership of the Union (as of September 13, 1993)

State	Member since
Australia	March 1, 1989
Belgium	December 5, 1976
Canada	March 4, 1991
Czech Republic	December 4, 1991
Denmark	October 6, 1968
Finland	April 16, 1993
France	October 3, 1971
Germany	August 10, 1968
Hungary	April 16, 1983
Ireland	November 8, 1981
Israel	December 12, 1979
Italy	July 1, 1977
Japan	September 3, 1982
Netherlands	August 10, 1968
New Zealand	November 8, 1981
Norway	September 13, 1993
Poland	November 11, 1989
Slovakia	December 4, 1991
South Africa	November 6, 1977
Spain	May 18, 1980
Sweden	December 17, 1971
Switzerland	July 10, 1977
United Kingdom	August 10, 1968
United States of America	November 8, 1981

How does protection of an innovation by patent compare with protection of a variety by plant variety protection?

17. Table 2 below gives an outline comparison between protection of an invention by patent and protection of a variety by plant variety protection.

Table 2: Comparison between protection by patent and protection by plant variety protection

	Patent Protection	Plant Variety Protection
I. Object of protection	(industrial) invention	plant variety
II. Requirement for protection		
1. documentary examination	required	required
2. field examination	not required	required

	Patent Protection	Plant Variety Protection
3. plant material for testing	not required (may be deposited, however)	required
4. conditions for protection	(a) novelty (b) industrial applicability (c) unobviousness (inventive step) (d) an enabling disclosure	(a) commercial novelty (b) distinctiveness (c) uniformity (d) stability (e) an appropriate denomination
III. Scope of protection		
1. determination of scope of protection	determined by the claims of the patent	fixed by the national legislation (or by the UPOV Convention in the case of UPOV member States)
2. use of a protected variety for breeding further varieties	may require authorization of the patentee	does not require authorization of the right holder (research exemption)
3. use of propagating material of the protected variety grown by a farmer for subsequent planting on the same farm	may require the authority of the patentee	does not generally require authorization of the right holder
IV. Variety denomination	not required	required
V. Term of protection	20 years	18 years for trees and vines, 15 years for other species (increased respectively to 25 years and 20 years in the 1991 Act)

In what circumstances should a country introduce a system of plant variety protection?

18. A system of plant variety protection is of interest to any country which believes that a system of incentives based upon exclusive rights for individuals or entities engaged in plant breeding will increase the quantity or effectiveness of plant breeding relevant to its conditions. UPOV member States include countries where plant breeding is effected by State owned entities, by private individuals or entities or by a mixture of both.

19. Each member State of UPOV has decided that a system of incentives based upon the principles of the UPOV Convention will enhance plant breeding for its conditions to the national benefit. States seek from the introduction of plant variety protection, variously, to increase national plant breeding activity, to encourage breeders from other countries to satisfy their particular requirements, to create secure conditions under which foreign breeders or seedsmen can produce seed of protected varieties for re-export, or to transform their national seed trade from a service role into the role of a research and development based industry.

Is the protection of plant breeders' rights harmful to the conservation of plant genetic resources?

20. Article 5(3) of the UPOV Convention expressly provides that a protected variety may be freely used by others to breed further varieties, i.e. it remains freely available as a plant genetic resource.

21. The experience of UPOV member States has shown that plant variety protection increases the number of breeders and, consequently, widens the spectrum of improved varieties available to farmers, with a potential increase in genetic variability.

22. The fact that new varieties offer substantial advantages to farmers does mean that farmers may choose to stop growing their existing varieties or land races in favor of new varieties, whether or not such plants are protected by plant breeders' rights. Ways must be found to make important new varieties available to farmers generally whilst encouraging the continued use by some farmers of their existing varieties or land races so as to conserve their genetic diversity.

23. The Food and Agriculture Organization of the United Nations (FAO) at its 25th Conference in November 1989 has endorsed an interpretation of the Undertaking on Plant Genetic Resources which accepts that there is no incompatibility between plant breeders' rights and the Undertaking.

How is plant variety protection administered at the national level?

24. Protection of new varieties is ensured in most UPOV member States by an application for protection addressed to the competent national authority appointed for the purpose.

25. The beneficial features of a newly developed variety can only be realized if authentic propagating material of the variety is made available.

26. Accordingly, in practice, there is an inevitable relationship between policies relating to the encouragement of plant breeding and policies directed to securing the availability of authentic high quality seed of plant varieties. Equally, many countries have chosen to permit the sale of new varieties of important crops only when the varieties have been independently tested in official trials.

27. Many of the current UPOV member States have built their national institutional arrangements for plant variety protection on the organizations responsible for seed quality control and variety testing. In many cases, the fulfillment of the technical conditions for plant variety protection, that is

to say distinctness, uniformity and stability, are already amongst the prerequisites for the entry of a variety into an official variety list.

28. It may frequently be appropriate for the protection of new plant varieties to be administered as part of a national agricultural policy for seed quality control and the establishment of a national list of varieties recommended for cultivation. It should be noted, however, that the UPOV Convention requires the granting of protection to be independent from decisions concerning the regulation of seed trading.

29. Alternatively, since plant variety protection is a form of intellectual property, a number of States have chosen to give responsibility for the administration of plant variety protection to State institutions which are responsible for one or more other forms of intellectual property. In Hungary, Italy (and very recently Ukraine), the patent office receives applications for and grants protection but delegates the technical examination of varieties for distinctness, uniformity and stability to the technical specialists of the Ministry of Agriculture. In New Zealand the system of plant variety protection is administered by an independent office in the Ministry of Commerce which is also responsible for patents and trademarks while in the United States of America, primarily for reasons of history, the protection of asexually reproduced varieties is the responsibility of the Patent Office while the protection of sexually reproduced varieties is the responsibility of the Plant Variety Protection Office of the Department of Agriculture.

What is the role of the UPOV Office?

30. The UPOV Convention established a "Union" of countries--the member States--which agreed to make available to breeders of other member States of the Union the same access to protection for their varieties as they made available to their own breeders. Any State with appropriate plant variety protection legislation has the opportunity through membership of UPOV to share in and benefit from the combined experience of the member States and to contribute to the worldwide promotion of plant breeding. A constant effort of intergovernmental cooperation is necessary to harmonize the activities of the member States and this requires the support of a specialized secretariat.

What does UPOV do?

31. The principal activities of UPOV are concerned with promoting international cooperation, mainly between its member States, and with assisting countries in the introduction of plant variety protection legislation.

32. Cooperation among the member States, particularly in the form of arrangements for the testing of varieties for distinctness, homogeneity and stability, is well established. Through such arrangements, member States are able to restrict both the cost and time of checking whether varieties qualify for protection. It is clear that such cooperation will have a beneficial effect on the level of investment in plant breeding in the member States and on the introduction of valuable varieties from one member State to another.

33. The fact that the Convention contains provisions on the basic conditions that must be included in the variety protection legislation of States wishing to join the Union leads, in itself, to a degree of harmony in the laws of the member States. This harmony, in addition to providing an obvious benefit to plant breeders, facilitates active cooperation between member States, at both

the administrative and the technical levels. The wish to operate as economically as possible has necessitated a continous process of improvement and refinement of that cooperation, generally on the basis of recommendations and model agreements and forms developed by the Union.

34. To accomplish its tasks, UPOV has established, under the auspice of the Council, the following bodies:

(1) Consultative Committee
(2) Administrative and Legal Committee
(3) Technical Committee.

The Technical Committee in turn has as subsidiary bodies the following Technical Working Parties:

(i) Technical Working Party for Agricultural Crops
(ii) Technical Working Party for Vegetables
(iii) Technical Working Party for Fruit Crops
(iv) Technical Working Party for Ornamental Plants and Forest Trees
(v) Technical Working Party on Automation and Computer Programs.

How do plant breeders exercise their rights in practice?

35. Article 5 provides that any authorization given by the breeder in relation to the production or marketing of his variety may be made subject to such conditions as he may specify. Subject to the provisions of individual national laws, the breeder is thus free to decide whether he will exploit his exclusive right by producing and selling all the reproductive or propagating material of his variety that is needed by the market himself or whether he will grant licences to others, perhaps in exchange for a royalty. The practice in individual States varies, but generally speaking in relation to species where very large volumes of seed must be produced and sold, and where the ease of keeping their own seed influences the price which farmers will be prepared to pay, the practice of plant breeders is to select the least-cost method of production and distribution. For example, in the case of small grain cereals, in most European countries, licences are granted very widely to organizations such as local cooperatives and grain merchants, who provide a wide range of services and supplies to farmers. Organizations of this kind produce seed locally under contract and sell it back to local farmers, thus minimizing the cost of transportation. The breeder is content to receive a royalty on each ton of seed which is sold. In the case of more specialized seed production such as the production of some cross-pollinating species, or of hybrid varieties or of high-quality vegetable seed, the practice of the breeder will probably be to control very tightly the production of seed in order to maintain the quality and reputation of his variety. In these cases he will seek his reward directly in the selling price of his own seed. Many different situations exist, however, depending upon the commercial structure of seed distribution in each country and the logistical aspects of the production and distribution of a particular species.

How can a country become a member of UPOV?

36. Participants will wish to know how a State can become a member of UPOV. First, the State must have enacted and be in a position to implement a law on plant variety protection which conforms with the rules established in the particular Act of the UPOV Convention to which it wishes to accede and it must then ask the Council of UPOV to advise it in respect of the conformity of its

laws with that Act. If the Council's advice is positive, the State in question must then deposit an instrument of accession (a form of legal document) to that Act of the Convention with UPOV and provide certain information to UPOV, including its proposed basis for financial participation. It will become a member of UPOV one month later.

37. The period since 1961 has seen a steady growth in the number of States which are members of UPOV. Today UPOV has 24 member States. We can hope to see something in excess of 30 countries, including a number of developing countries, with laws for the protection of new plant varieties, which conform with the UPOV Convention, by the mid-1990s. These countries will all have reached a decision to adopt a plant breeders' rights law after detailed and careful consideration of their national circumstances. They will all probably have concluded that plant breeding needs to be conducted in most cases within their national borders if they wish to secure the maximum benefit from the potential offered by plant breeding and that a system of incentives to plant breeders will bring about an increase in the total amount of plant breeding relevant to their territories. Such breeding, being undertaken in programs which are independent from each other, is likely to have diverse breeding objectives and deploy diverse genetic sources.

38. UPOV commends to you the 1978 Act of the Convention which is receiving increasing recognition throughout the world.

The 1991 Act of the Convention. Why was revision necessary?

39. The question immediately arises, however: "Why has it been necessary to revise such an excellent Convention and what changes have been incorporated into the new 1991 Act of the Convention?"

40. First, under the system of the 1978 Act, it is possible for breeders to discover that their particular varieties cannot be protected in a country because the species in question is not protected in that country. The 1991 Act provides for the eventual protection in all UPOV member States of all plant genera and species.

41. Secondly, under the 1978 Act, the breeder's protection enabled him only to control marketing of the reproductive material of his variety and production of such material for the purpose of marketing. A number of difficulties arose with this formulation of the breeder's right. It had the advantage for farmers that the production of seed on their farms for sowing on their farms fell outside the scope of protection but it had the effect also that a person could buy one fruit tree and use it, after propagation, to plant a vast orchard with no obligation to the breeder. The modern techniques of tissue culture multiply the potential for this kind of misuse of the breeder's variety. The 1991 Act accordingly extends the breeder's protection to all production and reproduction of his variety BUT permits member States on a discretionary basis to exempt from the breeder's right any traditional form of saving seed on the farm which they wish to retain.

42. Thirdly, under the 1978 Act, a variety can be taken to a country which does not provide protection for new plant varieties and used there to produce an end product, say, cut flowers, which is exported back to a country where the breeder's variety is protected. The breeder receives no remuneration from the exploitation of his variety in this way. The 1991 Act extends the breeder's protection in very limited circumstances to the harvested material of his

variety so as to enable him to seek some reward from the exploitation of his variety in the kind of circumstance described above.

43. Fourthly, under the 1978 Act, a protected variety can be modified in a very limited respect, e.g. by reselection, mutation, the addition of a gene, etc., and, provided the modified variety is clearly distinguishable from the protected variety, it can be separately protected without any obligation to the breeder of the protected variety. The 1991 Act provides that varieties that are "essentially derived" from a protected variety in this way can still be protected but cannot be exploited without the permission of the breeder of the protected variety from which they are derived. Varieties are "essentially derived" for this purpose only when they are virtually entirely constructed upon the basis of the protected variety from which they are derived. This provision is designed to discourage parasitical breeding approaches.

44. There are other changes in the 1991 Act but the changes to which reference has been made are the major substantive changes to which your attention needs to be drawn.

45. The changes which have been made are very rational and will provide plant breeders with a form of protection adapted to the needs of the twenty-first century which represents under today's circumstances a fair balance between the interests of the breeders of new varieties on the one hand and the interests of the users of new varieties (farmers and consumers) on the other hand.

AN OVERVIEW OF PLANT VARIETY PROTECTION IN THE WORLD (THE DEVELOPMENT OF UPOV; THE FORM OF PROTECTION; IMPLEMENTATION AT THE NATIONAL LEVEL)

I. DEVELOPMENT OF UPOV

1. The UPOV Convention was signed, on the closure of the Diplomatic Conference for the Protection of New Varieties of Plants, on December 2, 1961, by Belgium, France, Germany (Federal Republic of), Italy and the Netherlands. The Convention (the 1961 Act of the Convention) was further signed by Denmark on November 26, 1962, Switzerland on November 30, 1962, and the United Kingdom on November 26, 1962.

2. The UPOV Convention entered into force on August 10, 1968, following ratification by Germany. The two earlier ratifications had been those by the United Kingdom (1965) and by the Netherlands (1967). For a chronicle of the development in the membership of UPOV see Table 1 below.

Table 1: Chronological table of the development of UPOV

1957-1961	Diplomatic Conference for the Protection of New Varieties of Plants
1961 Dec. 2	Signature of the UPOV Convention
1965 Sep. 17	Ratification by the United Kingdom
1967 Aug. 8	Ratification by the Netherlands
1968 July 11	Ratification by Germany (Fed. Rep. of)
1968 Aug. 10	Entry into force of the UPOV Convention
1968 Sep. 6	Ratification by Denmark
1968 Nov.	The first ordinary session of the UPOV Council
1971 Sep. 3	Ratification by France
1971 Nov. 17	Accession of Sweden
1972 Nov.	Diplomatic Conference for the Modification of the International Convention for the Protection of New Varieties of Plants
1976 Nov. 5	Ratification by Belgium
1977 June 1	Ratification by Italy
1977 June 10	Ratification by Switzerland
1977 Oct. 7	Accession of South Africa
1978 Oct.	Geneva Diplomatic Conference on the Revision of the International Convention for the Protection of New Varieties of Plants
1979 Nov. 12	Accession of Israel to the 1961/1972 Act
1980 Apr. 18	Accession of Spain to the 1961/1972 Act
1980 Nov. 3	Ratification by New Zealand of the 1978 Act
1980 Nov. 12	Acceptance by the United States of America of the 1978 Act
1981 May. 19	Ratification by Ireland of the 1978 Act
1981 Nov. 8	Entry into force of the 1978 Act
1982 Aug. 3	Ratification by Japan
1983 Mar. 16	Accession of Hungary
1989 Feb. 1	Accession of Australia
1989 Nov. 11	Accession of Poland
1991 Feb. 4	Ratification by Canada
1991 March	Diplomatic Conference for the Revision of the International Convention for the Protection of New Varieties of Plants
1991 Nov. 4	Accession of Czechoslovakia

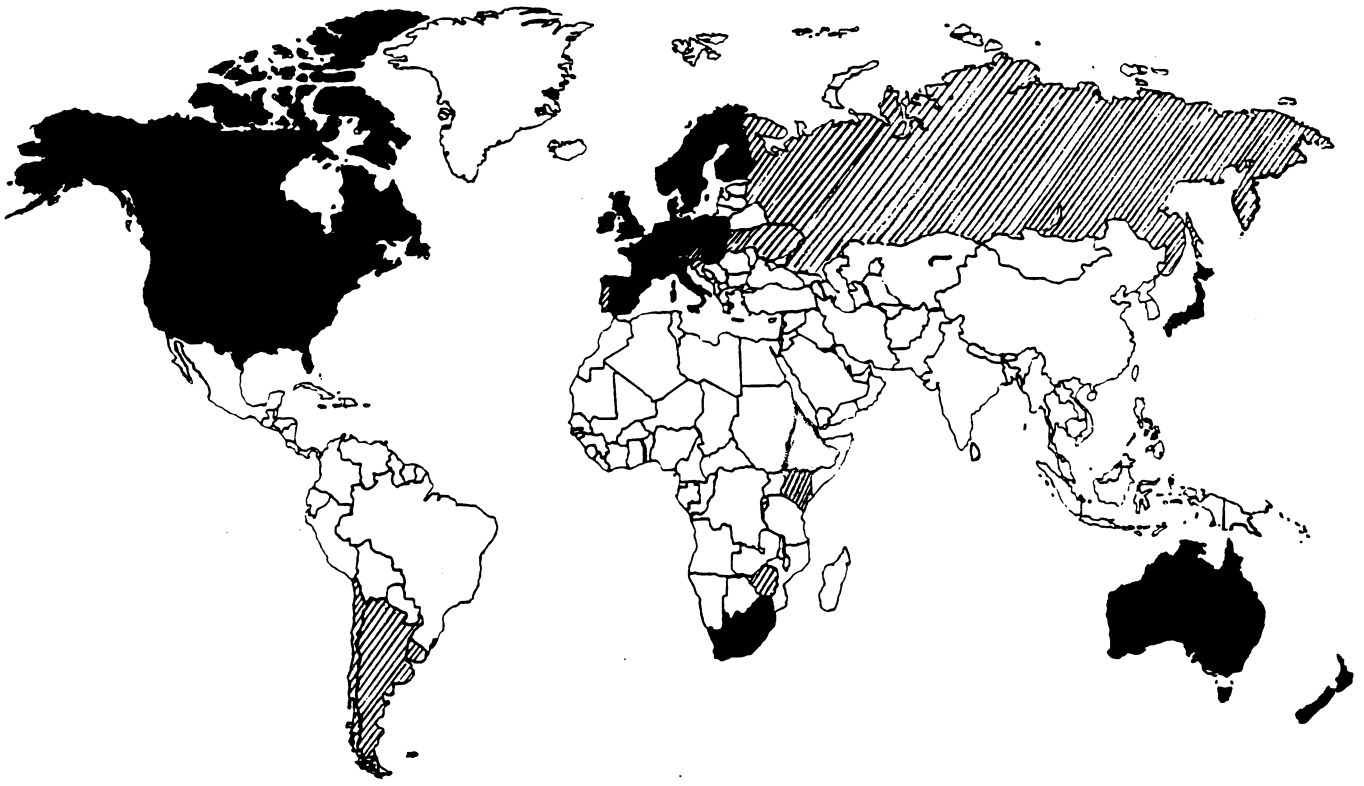
1993 Jan. 12	Declarations of continued application of the UPOV Convention to the Czech Republic and Slovakia
1993 March 16	Accession of Finland
1993 Aug. 13	Accession of Norway

3. The yearly development of UPOV in terms of the number of member States and the number of protection titles issued and the number of protection titles in force in the member States is illustrated in Figure 2 overleaf.

4. At present UPOV consists of the following 24 member States:

Africa :	South Africa
America:	United States of America, Canada
Asia :	Israel, Japan
Europe :	Belgium, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Slovakia, Spain, Sweden, Switzerland, United Kingdom
Pacific:	Australia, New Zealand

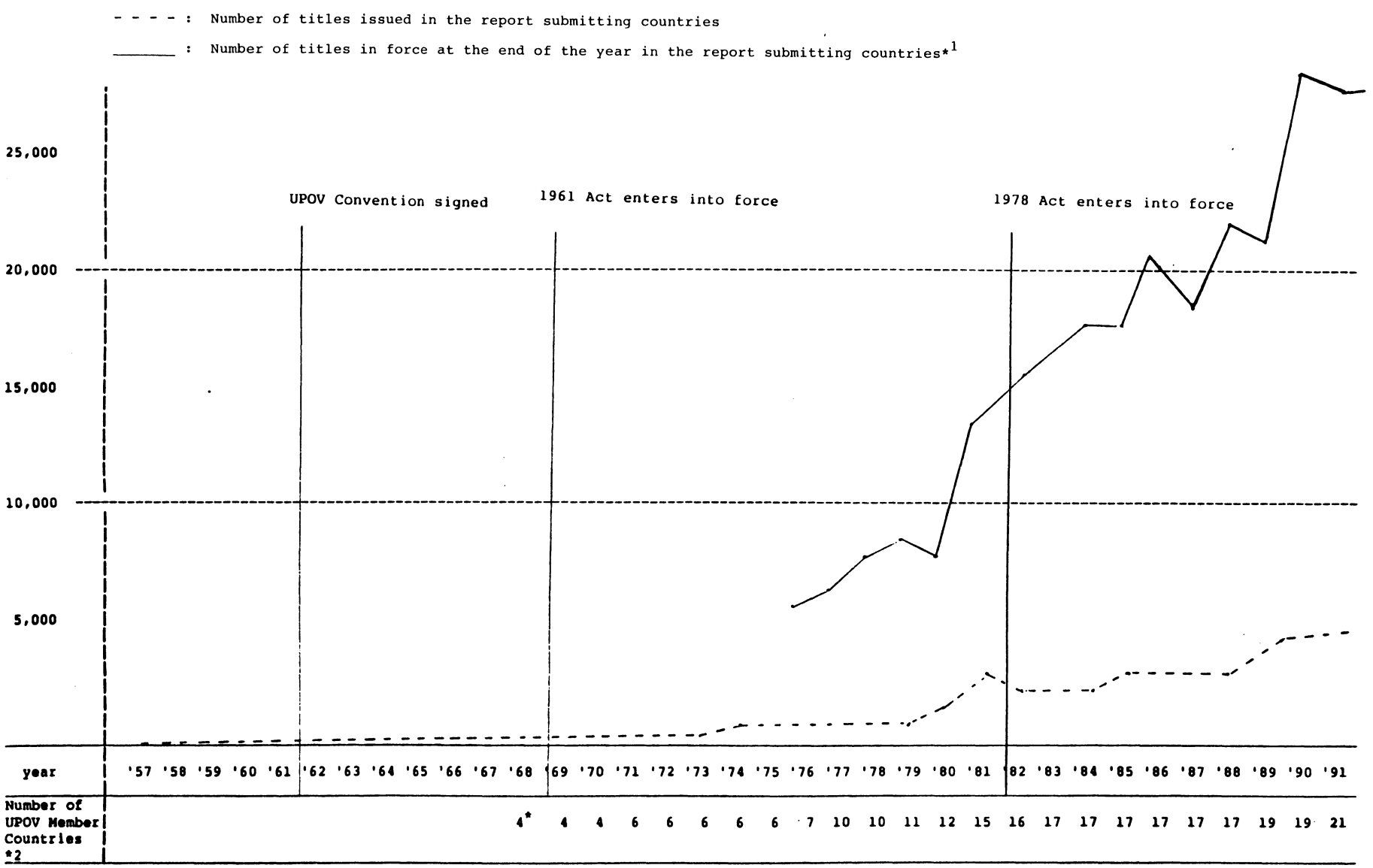
Fig. 1: Geographical distribution of the UPOV member States



Member States of UPOV as of September 13, 1993
States having laws on plant variety protection

5. Statistics of applications for protection filed and protection titles granted in the member States in 1991 are given in Table 2 on page 28.

Fig.2: Development of Plant Variety Protection (Source: WIPO statistics on the Protection of New Plant Varieties)



*1 Data available only since 1975

*2 Countries submitting statistical reports before the entry into force of the UPOV Convention were the following: the United States of America (since 1949); Denmark; Germany; the Netherlands (since 1964); the United Kingdom (since 1966)

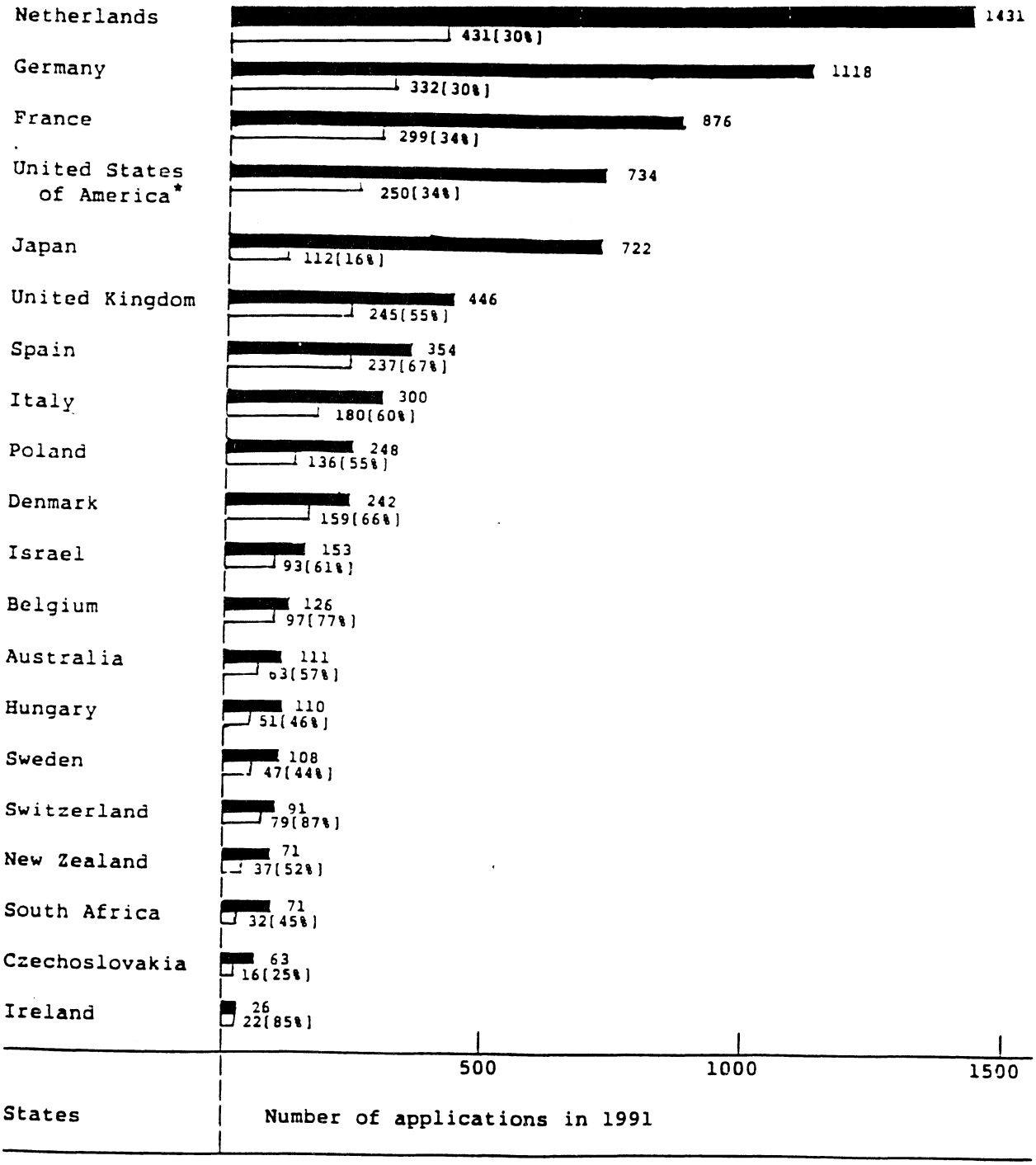
Table 2: Applications filed and titles issued for the protection of plant varieties in member States of UPOV in 1991

State		Title* of Protection	Applications	Titles issued	Titles having ceased	Titles in force at the end of the year
UPOV Member States						
AU	Australia	PVP	111	61	-	149
BE	Belgium	PVP	126	108	63	412
CA	Canada	PVP	-	-	-	-
CH	Switzerland	PVP	91	58	39	404
CS	Czechoslovakia	PVP	63	-	-	-
DE	Germany	PVP	1118	576	507	4077
DK	Denmark	PVP	242	250	92	1176
ES	Spain	PVP	354	-	10	644
FR	France	PVP	876	570	405	3684
GB	United Kingdom	PVP	446	359	289	1829
HU	Hungary	Patent	110	49	12	144
IE	Ireland	PVP	26	21	25	104
IL	Israel	PVP	153	82	38	624
IT	Italy	Patent	300	325	-	-
JP	Japan	PVP	722	418	170	2343
NL	Netherlands	PVP	1431	855	697	3832
NZ	New Zealand	PVP	71	91	32	462
PL	Poland	PVP	248	69	1	141
SE	Sweden	PVP	108	53	56	327
US	United States of America	PVP	271	215	133	2418
		Patent	463	353	157	4175
ZA	South Africa	PVP	71	67	25	544
TOTAL			7401	4580	2751	27481

* See paragraphs 13 to 16.

6. The ratio of domestic varieties/foreign varieties varies from country to country. In general, in European member States, the portion of foreign varieties for which protection has been granted is very high (see Fig. 3 below).

Fig. 3: Use of plant variety protection in the member States of UPOV



: total applications

: foreign applications

[ ] : percentage of foreign applications

* Total of applications under the Plant Variety Protection Act and the Patent Law

II. SPECIES PROTECTED

7. The UPOV Convention is applicable to all botanical taxa. The 1978 Act of the UPOV Convention provides that the member States of the Union undertake to adopt all measures necessary for the progressive application of the provisions of the Convention to the largest possible number of botanical genera and species and lays out the following time schedule and minimum numbers of genera and species that must be protected:

(i) on the entry into force of the Convention in the territory, at least five genera or species;

(ii) within three years, at least 10 genera or species;

(iii) within six years, at least 18 genera or species;

(iv) within eight years, at least 24 genera or species.

8. Among the current UPOV member States Australia, Germany, Hungary, the Netherlands, New Zealand and the United States of America protect all botanical taxa. The other member States currently limit the protection of plant varieties to specific categories of plants which are defined by reference to the taxonomical hierarchies (order, class, genus, species, subspecies, etc.) and published in the form of a list of plant taxa eligible for protection. The decision on the extension of such a list usually reflects the species of importance in each country and the species for which, as a consequence, a demand for protection exists. Protection is also extended in some countries to edible mushrooms (France, Japan, Netherlands, etc.) and to seaweeds (Japan).

9. Under the provisions of the 1991 Act of the Convention member States have the obligation to extend protection to all plant genera and species at the latest by the expiration of a period of five years after the entry into force of that Act in their territory. A new member State of the Union, bound only by the 1991 Act, must protect, at the date on which it becomes bound by that Act, at least 15 plant genera and species and, by the expiration of a period of 10 years from the said date at the latest, all plant genera and species.

10. The 1991 Act of the UPOV Convention leaves to each member State the interpretation of the words "all botanical genera and species." In most UPOV member States plant variety protection is granted to varieties belonging to vascular plants (Tracheophytina); protection is not extended in most UPOV member States to other taxa like bacteria or fungi.

11. Table 3 on page 31 shows the coverage by plant variety protection systems of the current member States of UPOV in terms of the number of protected botanical taxa. UPOV publishes every year a complete list of botanical taxa protected in its member States and distributes it to interested circles.

12. Table 4 on page 32 shows the 10 most protected plant species and their number of protection titles in six UPOV member States.

III. FORM OF PROTECTION

13. Article 2(1) of the 1978 Act of the UPOV Convention reads as follows:

> "Each member State of the Union may recognize the right of the breeder provided for in this Convention by the grant either of a

special title of protection or of a patent. Nevertheless, a member State of the Union whose national law admits of protection under both these forms may provide only one of them for one and the same botanical genus or species."

The first sentence of this Article gives each member State a free hand in deciding on the form of protection; the plant variety right may be granted either in the form of a patent or in the form of a special title of protection, such as a "Certificate of Plant Variety Protection" or a "Plant Breeder's Right." The second sentence contains the so-called "ban on double protection" and was introduced to avoid possible problems arising from the coexistence of different schemes for the protection of varieties with different conditions for protection and different scopes of protection.

14. Most of the current 24 member States of UPOV have introduced a plant variety protection system in the form of a special title of protection. Two member States, Italy and Hungary, have introduced plant variety protection by adding special provisions to their patent laws. It is to be noted that the contents of the rights granted to the breeders of new plant varieties in Italy and Hungary is not different from the contents of the rights granted in the form of a special title of protection in the other member States; these rights in Italy and Hungary are called "patent rights," but are otherwise identical to the plant breeders' rights granted in other countries.

Table 3: Number of Protected Taxa

Country	Division	Order	Family	Genus	Species	Subspecies
AU	all plant species (except fungi, algae, bacteria)					
BE			1	115	99	20
CA				2	6	
CH	1		141			
CZ				19	84	18
DE	all plant species					
DK				40	90	18
ES				2	32	
FR			1	34	69	1
GB		1	1	255	159	14
HU	all plant species					
IE				6	21	4
IL				52	64	2
IT				43	35	1
JP				233	188	9
NL	all plant species					
NO				24	20	10
NZ	all plant species (except fungi, algae, bacteria)					
PL				26	174	31
SE				30	60	13
SK				19	84	18
US	all plant species					
ZA				32	64	10

Table 4: Plant species which are most protected and the respective numbers of protected varieties

Country	1	2	3	4	5	6	7	8	9	10
FRANCE (as of May 1, 1991)	Maize (720)	Chrysanthemum (502)	Rose (387)	Sunflower (186)	Pelargonium (184)	Soft Wheat (145)	Potato (133)	Barley (132)	French Bean (122)	Carnation (121)
GERMANY (as of Apr. 1, 1992)	Rose (470)	Maize (342)	Chrysanthemum (316)	Potato (195)	Perennial Ryegrass (160)	Zonal Pelargonium (155)	Barley (137)	Sugar Beet (130)	Carnation (105)	Red Fescue (103)
JAPAN (as of Dec. 16, 1991)	Rose (214)	Rice (151)	Carnation (143)	Chrysanthemum (123)	Cymbidium (116)	Lily (67)	Common Stock (66)	Shiitake (62)	Peach (49)	Citrus (43)
NETHERLANDS (as of Dec. 31, 1991)	Chrysanthemum (362)	Rose (342)	Lily (301)	Carnation (301)	Ryegrass (177)	Gerbera (155)	Potato (262)	Freesia (118)	Alstroemeria (114)	Geranium (101)
UNITED KINGDOM (as of Dec. 31, 1991)	Rose (442)	Chrysanthemum (261)	Pea (including Field Pea) (117)	Potato (109)	Barley (98)	Pelargonium (102)	Perennial Ryegrass (81)	Wheat (64)	Swede Rape (48)	Alstroemeria (41)
UNITED STATES OF AMERICA* (as of Dec. 31, 1990)	Soybean (487)	Wheat (217)	Pea (194)	Cotton (175)	Corn (162)	Garden Bean (149)	Lettuce (85)	Alfalfa (71)	Perennial Ryegrass (68)	Tall Fescue (56)

* Only varieties protected under the Plant Variety Protection Act

Table 4: Plant Species which are most protected and the.. Numbers of Protect Variations

15. Under the national patent laws of many countries and under some regional treaties (e.g. the European Patent Convention), plant (and animal) varieties are excluded from patent protection. Currently a patent may not be granted for plant varieties in the following countries: Algeria, Austria, Bahamas, Barbados, Belgium, Brazil, Bulgaria, Canada, Chile, China (except for relevant processes), Cuba, Cyprus, Czech Republic, Democratic People's Republic of Korea, Denmark, European Patent Convention, Finland, France, Gambia, Germany, Ghana, Greece, Iceland, Indonesia[1], Israel, Kenya, Lesotho, Luxembourg, Madagascar, Malaysia, Netherlands, Nigeria, Norway, Organization africaine de la propriété intellectuelle[2], Peru, Poland, Portugal, Republic of Korea (except plant varieties which are asexually reproduced), Saudi Arabia, Slovakia, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Thailand, Uganda, United Kingdom, United Republic of Tanzania, Yugoslavia.

16. The United States of America has a special position among the current member States of UPOV with regard to its forms of protection. The United States of America introduced plant variety protection as early as 1930 for asexually propagated varieties (except tuber plants) by enacting the "Plant Patent Act." Although this is called a "Plant Patent," it is in fact a sui generis protection right which is in most respects compatible with the UPOV Convention. A similar "Plant Patent" was introduced in Cuba in 1937, in South Africa[3] in 1952 and in the Republic of Korea in 1979, but plant patents have in practice only been granted on a significant scale in the United States of America. The breeders of sexually propagated plants had to wait until 1970 when the Plant Variety Protection Act was introduced to secure protection in the United States of America. The coexistence of the "Plant Patent Act" and the "Plant Variety Protection Act" became an obstacle preventing the United States of America from joining the 1961 Act of the UPOV Convention which requires, under its Article 2(1), that varieties belonging to one and the same genus or species be protected by only one form of protection. However, since there are botanical genera and species which can be propagated both sexually and asexually, the potential existed in the United States of America for protection to be granted by both plant patent and plant variety protection certificates for varieties of the same species. The membership of the United States of America became possible only after the revision of the UPOV Convention in 1978, where exceptional rules for protection under two forms were introduced (Article 37). The United States of America acceded to the UPOV Convention in 1981 (the provisions of Article 37 are such that only the United States has been able to take advantage of this Article). Furthermore, after the decision of the US Board of Patent Appeals and Interferences of September 18, 1985 (Hibberd Case), it is thought that an industrial patent (Utility Patent) can now be granted in the United States of America for new varieties of plants. Accordingly, there are three forms of protection currently available for the protection of new plant varieties in the United States of America.

IV. THE IMPLEMENTATION OF THE UPOV CONVENTION AT THE NATIONAL LEVEL

17. Each country's authority competent for plant variety protection is required to carry out the following tasks (Table 5):

---

1 Patents cannot be granted to food crops.

2 Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Congo, Côte d'Ivoire, Gabon, Guinea, Mali, Mauritania, Niger, Senegal, Togo.

3 South Africa introduced the Plant Breeders' Rights Act later in 1976.

(i) to receive an application; and, after documentary examination, to file the application;

(ii) to carry out or arrange the substantive examination of the application in the light of the five criteria (commercial novelty, distinctness, uniformity, stability, an appropriate variety denomination);

(iii) to issue a protection title if the application fulfills all the criteria; or to refuse the application in the contrary case;

(iv) to administer the issued protection title, including the collection of annual fees, and if the protected variety loses the qualification for protection, to cancel or annul the protection title;

(v) to publish information on variety protection, including information on the filing of applications, the grant of rights with variety descriptions, the cancellation or nullity of rights, the grant of compulsory licenses, etc.

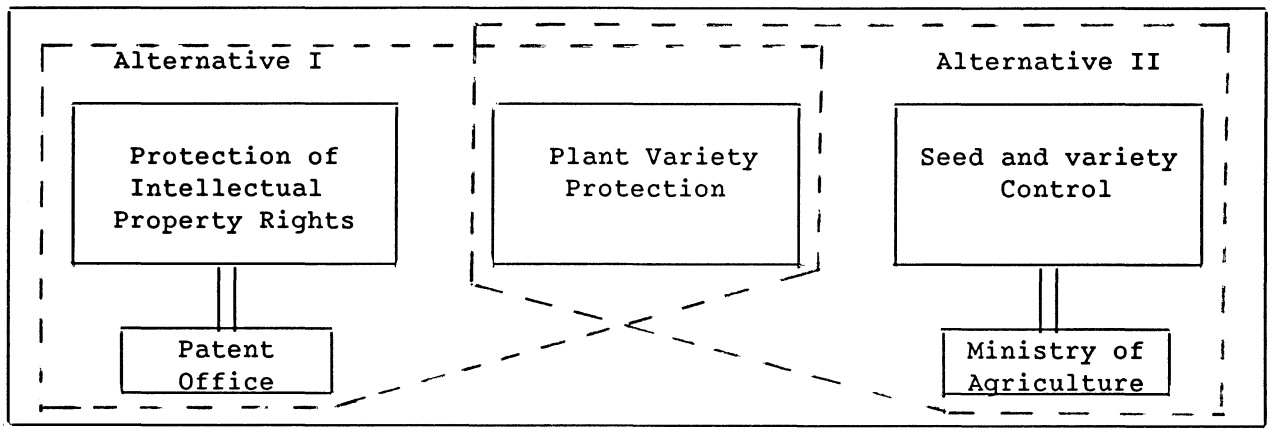
Table 5: Tasks of the Plant Variety Protection Office

Procedures for Plant Variety Protection	Tasks of the Plant Variety Protection Office
1. Application for protection	- to receive an application with the application fee - to check the application - to publish the application
2. Testing of the candidate variety	- to carry out or to arrange for the testing - to decide whether DUS criteria are followed
3. Grant of a title of protection	- to register the variety and to issue a title of protection - to publish the registration
4. Maintenance and supervision	- to receive annual maintenance fees - to grant a compulsory license - to cancel the protection title - if necessary, to supervise the maintenance of the variety
5. Appeals	- to hear appeals

18. The two principal purposes of plant variety protection, that is to say the protection of the intellectual property rights of breeders on the one hand and the promotion of agricultural production on the other, lead to the possibility that plant variety protection can be administered either by the authorities responsible for intellectual property rights protection or by the

authorities responsible for agriculture. In the latter case the most relevant governmental services are those involved in seed and variety regulation. Thus, as Fig. 4 below shows, the service of plant variety protection may be integrated into the intellectual property office, such as the Patent Office (Alternative I) or into the seed and variety control service of the Ministry of Agriculture (Alternative II).

Fig. 4: Plant Variety Protection and Related Functions of the Government



19. In current member States of UPOV, plant variety protection is administered as follows (see Table 6):

(i) Alternative I - Patent Office (Ministry of Commerce).- In Italy and Hungary, where plant varieties are protected by the granting of a so-called "patent," the patent office is the competent authority for the protection of new plant varieties. In Italy, where all administrative work is done by the patent office, l'Ufficio Centrale di Brevetti, the Ministry of Agriculture undertakes the testing of varieties. A similar "division of labor" is also found in Hungary. In New Zealand, where new plant varieties are protected by a plant variety rights law, the Plant Variety Rights Office was transferred from the Ministry of Agriculture to the Ministry of Commerce with a view to having all intellectual property matters administered by that Ministry.

(ii) Alternative II - Ministry of Agriculture.- In most of the UPOV member States, the protection of new plant varieties is administered directly by the Ministry of Agriculture (Canada, Japan, Switzerland, etc.) or by a special office under the Ministry of Agriculture established for the purpose of the protection of new varieties. As technical work for the purpose of establishing national lists of varieties which may be commercialized (in countries which have such lists) largely overlaps with such work for the protection of new plant varieties, in many cases such work is dealt with by the same authorities (in most of the European member States for example). A certain independence of the competent office from the government is thought to be necessary in some countries (e.g. France) where government research institutes and private breeding companies compete.

(iii) Variation of Alternative II - Independent Office.- In Germany the protection of new plant varieties is administered by an independent office. The Bundessortenamt (Federal Plant Variety Office) of Germany is an independent federal superior institute under the Federal Minister of Agriculture. The Plant Variety Rights Office of the United Kingdom is under the immediate supervision of the Controller of Plant Variety Rights who is appointed by the Government. While the Bundessortenamt has a large number of stations which

carry out all necessary examinations, the Plant Variety Rights Office of the United Kingdom does not carry out variety examinations itself. It subcontracts this task to independent institutions.

20. In the United States of America the the Plant Variety Protection Act, which concerns sexually propagated plant species, is administered by the Plant Variety Protection Office established within the Department of Agriculture. Plant patents for asexually propagated varieties and utility patents (industrial patents), where granted for inventions involving plant varieties, are administered by the United States Patent and Trademarks Office in the Department of Commerce.

Table 6: Summary of the Institutional Structure for the Implementation of the UPOV Convention:

(i) Ministry of Agriculture (16 States)	Australia, Belgium, Canada, Denmark, Finland, France, Ireland, Israel, Japan, Netherlands, Norway, Poland, South Africa, Spain, Sweden, United States of America[1]
(ii) Patent Office (3 States)	Hungary[2], Italy[2], United States of America[1]
(iii) Independent Office (2 States)	Germany, United Kingdom
(iv) Others (2 States)	Czech Republic[3], New Zealand[4]

[1]: The Plant Variety Protection Act is administered by the Plant Variety Protection Office under the Department of Agriculture. The Plant Patent Act is administered by the US Patent and Trademark Office under the Department of Commerce

[2]: Examinations are carried out by the Ministry of Agriculture

[3]: The Ministry of Economy, Division of Agriculture and Food

[4]: The Plant Variety Rights Office is now under the Ministry of Commerce

S E C O N D S E S S I O N

GENERAL INFORMATION ON THE UPOV SYSTEM OF PLANT VARIETY PROTECTION

THE TECHNICAL CRITERIA FOR PROTECTION

Speaker: Mr. Makoto Tabata, Office of UPOV, Geneva, Switzerland

THE 1991 ACT OF THE UPOV CONVENTION

Speaker: Mr. Barry Greengrass, Vice Secretary-General of UPOV, Geneva, Switzerland

Chairman: Mr. Fei Kaiwei, Director General, Department of Science and Technology, Ministry of Agriculture, Beijing, China

THE TECHNICAL CRITERIA FOR PROTECTION

I. WHAT SHOULD BE REQUIRED FOR A VARIETY TO BE PROTECTED?

1. The effective enforcement of the breeder's right requires that the subject matter of the right, the protected variety, should be clearly defined so as to enable the identification of samples of the protected variety under the practical circumstances of the world's seed and plant industries. In the last resort it may be necessary to demonstrate in a court of law that a particular sample is indeed a sample of a particular protected plant variety.

2. If the system of plant variety protection is to provide an effective incentive for investment in plant breeding, plant breeders need to know that their right can be effectively enforced. Equally the public at large needs to be able to ascertain, and has a right to know, whether a particular sample offered in commerce is or is not a sample of a protected variety. In other words a plant breeders' rights system must offer a high degree of legal certainty.

3. The establishment of a clear identity for a variety logically involves the following elements:

(i) the variety should be clearly distinguishable from any other existing variety; it must be different;

(ii) the variety should be sufficiently homogeneous (uniform) to enable its description;

(iii) the variety should keep its important characteristics, that is, it must remain true to its initial description even after repeated reproduction or multiplication.

All these criteria must be fulfilled in order that a variety can be regarded as clearly defined and thus protectable. Accordingly each variety for which an application for protection is filed must undergo a technical examination during which its Distinctness, Uniformity and Stability is assessed. This is usually referred to as DUS testing.

4. There are two additional criteria which must be satisfied before a variety can be protected:

(i) **The variety should be new (commercial novelty).-** It is a fairly obvious matter that a variety must be new to qualify for protection. If a variety to which people have had free access in the past (an "old" variety) comes to be eligible for protection the interests of people who have relied upon free access to it would suffer prejudice. Accordingly an acceptable plant variety protection system must require that a variety should be new, or more precisely, that a variety should not have been commercialized for a long period before the filing of an application for protection, in order to protect bona fide users of the variety.

(ii) **The variety should be given an appropriate variety denomination.-** Users and consumers need to have some ready means of knowing that a sample is a sample of a particular identified plant variety. This is accomplished by requiring that a particular denomination, and no other, be used to identify a variety in trade.

5. Accordingly, the UPOV Convention adopts the following criteria as the basis for protection:

- commercial novelty
- distinctness
- uniformity
- stability
- an appropriate denomination

(distinctness, uniformity and stability: DUS testing)

6. The UPOV Convention further provides that the grant of the breeder's right shall not be subject to any further or different criteria in order to ensure that rights are granted in UPOV member States on a harmonized basis.

7. In most of the UPOV member States, plant variety protection is administered by an institution which is responsible for seed quality control and variety testing. This is explained by the fact that all these criteria, except commercial novelty, are amongst the requirements to be fulfilled before a variety can be authorized for commercialization.

8. It should be especially noted that the inventive step (unobviousness), which is a criterion for patent protection, and the merit or economic usefulness of the variety, which may be a criterion for a variety to be authorized for commercialization in States where a so-called "national list" of varieties exists, are excluded from the criteria for plant variety protection.

II. THE INDIVIDUAL CRITERIA

9. The basic criteria for the protection of new varieties which were established in the original 1961 text of the Convention have remained essentially unchanged in the various revisions of the Convention. Changes have been made in wording but without any major change in the underlying concepts. This paper analyses the criteria for protection on the basis of the 1978 Act. The next speaker will highlight those small changes that were introduced to these criteria in the 1991 Act.

Commercial Novelty

10. According to the 1978 Act of the Convention (Article 6(1)(b), first sentence), at the time of the application for protection in a member State of the Union, a new variety must not have been offered for sale or marketed, with the agreement of the breeder or his successor in title, in the territory of that State, or for longer than six years (in the case of trees and vines) and for four years (in the case of all other plants) in the territory of any other State.

11. Contrary to the situation in the patent system, the availability to the public of mere information on or of a description of the variety does not destroy its novelty. This is based on the reasonable assumption that nobody can reproduce a variety merely on the basis of information or a description and without access to material of the variety. In this context, a court in France recently decided that inbred lines of maize, which had been used for the commercial production of hybrid maize seed for several years prior to the filing of an application for protection, were nevertheless novel, because the lines had been used only in a closed circle and kept from public access (under a law based upon the 1991 Act of the Convention, there might well have been a different outcome).

12. The grace periods for commercialization abroad of six years and four years are included to give the applicant time to carry out tests and trials before deciding whether or not to apply for protection in further States.

13. As it is sometimes necessary to see the response of the market to new varieties before deciding whether or not to apply for protection, some member States bound by the 1978 Act of the Convention allow a grace period of one year prior to the filing of applications during which commercialization is not regarded as harmful to novelty. Under the 1991 Act of the Convention every Contracting Party must grant this grace period.

Distinctness

14. Whatever the origin of the initial variation, artificial or natural, from which the variety has resulted, the new variety must be clearly distinguishable by one or more important characteristics from any other variety whose existence is a matter of common knowledge at the time of application for protection. A variety may be regarded as distinct whatever the breeding method and starting material used by the breeder.

14. When determining which varieties are regarded as commonly known, the following aspects should be noted:

(i) The test for distinctness is a worldwide test. The varieties that are taken into account should not be limited to national borders. However, the experts know what foreign varieties are likely to be relevant for distinctness purposes and which will not be relevant. In examining wheat in Kansas, United States of America, for example, it is not necessary to consider wheats from north-west Europe. The examiner knows that the disease spectrum and other environmental differences are so great, that varieties from north-west Europe are bound to be different.

(ii) In the case of new varieties it was generally understood that under the 1978 Act an application for protection of a new variety anywhere in the world makes that variety commonly known as from the date of the application, notwithstanding the fact that the existence of the application is only known in the office that received it. This general understanding has been expressly confirmed in the 1991 Act which provides that an application for protection or for the entry of a variety in an official register anywhere in the world causes the variety to be regarded as a matter of common knowledge. However, if the application is subsequently rejected, the variety which was the subject matter of the application is disregarded for distinctness purposes.

(iii) Careful consideration must be given to extinct or lost varieties which have completely died out and which exist only in literature. Their descriptions are unlikely to have the precision necessary for protection purposes unless they were themselves protected varieties in the past.

16. A characteristic is understood to be "important" when it is useful for the purpose of distinguishing varieties. It does not mean important in the sense that the characteristic must relate to the agronomic merit of the variety. UPOV Test Guidelines recommend those characteristics which should be regarded as important and suitable to be used for DUS Testing. Characteristics relevant to the agronomic merit of a variety are included when they are particularly suitable for DUS testing. Examples include maturity, plant height and pest and disease resistance when such resistance can be precisely tested and is critical for distinctness.

17. It should be specially noted that the superiority or usefulness of a variety is not one of the criteria for protection. It is generally agreed that the superiority or usefulness of a variety will be influenced by many factors and will fluctuate from time to time. Especially in the case of ornamental plants it is of no use to discuss their "superiority." As far as shapes and colors are concerned, these are rather a matter of taste. The standpoint of the protection system is that it is for the users of the variety to decide on the superiority or usefulness of the variety and not for the plant variety protection office.

18. The minimum degree of distinctness from the nearest (or most similar) variety for the purpose of protection has been discussed for many years using the term "minimum distances between varieties." The term describes one aspect of the scope of protection of varieties; the larger the minimum distance the stronger the protection. The distance between varieties can be broken down into two factors: the degree of importance of a particular characteristic and the (one-dimensional) distance between varieties in a given characteristic. Accepting a small distance permits plagiarism, possibly resulting in a loss of potential income for the breeder of the original variety. Accepting a greater distance tends to monopoly, possibly discouraging the release of other improved varieties.

Uniformity

19. The new variety must be homogeneous, having regard to the particular features of its sexual reproduction or vegetative propagation.

20. An acceptable level of uniformity is a prerequisite not only for a variety to be clearly defined but also for a variety to be usable for agricultural production. A lack of uniformity may downgrade the quality of the end product.

21. The degree of uniformity is determined taking into account the particular features of the variety's propagation. Procedures currently applied in assessing uniformity are explained in paragraphs 42 to 49.

Stability

22. The new variety must be stable in its essential characteristics, that is to say, it must remain true to its description after repeated reproduction or propagation or, where the breeder has defined a particular cycle of reproduction or multiplication, at the end of each cycle.

23. In the case of some self-pollinating species, such as barley and rice, breeding work comes to an end when the characteristics of varieties have been genetically fixed, i.e. do not fluctuate, usually several generations after the original crossing. Varieties which lack stability at the time of application are regarded as unfinished and are rejected as would be the case with an incomplete invention which had not been reasonably reduced to practice.

24. Stability, as well as uniformity, may be lost after a protection title has been granted. In this case the Convention envisages the cancellation of the protection if the rights holder fails to maintain the variety true to the description established when the rights were granted.

An Appropriate Denomination

25. To be acceptable a variety denomination must be destined to be the generic designation of the variety (Article 13(1) of the 1978 Act of the UPOV Convention). The word "generic" is not used here in its botanical sense but with the meaning "a word which is used generally to describe an item." The following consequences flow from the premise that the variety denomination must be its generic designation:

(i) the variety denomination must enable the variety to be identified;

(ii) the free use of the variety denomination should not be hampered after the expiry of protection by other rights, such as trademarks;

(iii) the variety denomination does not have the function of indicating the origin and ownership of the variety or the origin of particular propagating or other material of the variety; indicating the trade origin of goods is the function of a trademark. However, it is permitted to associate a trademark, trade name or other similar indications with a registered variety denomination.

(iv) The variety must be registered in member States of the Union under the same denomination, unless the national authority considers the denomination unsuitable in its State (national authorities of the UPOV member States exchange information on variety denominations and may address observations on proposed variety denominations filed with other authorities) (see paragraph 57).

26. Furthermore for a variety denomination to be suitable, Article 13 of the 1978 Act requires in addition that the denomination:

(i) may not consist solely of figures, except where this is an established practice for designating varieties;

(ii) must not be liable to mislead or to cause confusion concerning the characteristics, value or identity of the variety or the identity of the breeder;

(iii) must be different from every denomination which designates, in any member State of the Union, an existing variety of the same botanical species or of a closely related species.

27. To secure that the above conditions are interpreted in the same way in all the member States of UPOV and since, pursuant to Article 13(5) of the 1978 Act, the same variety denomination must, where possible, be approved by all the member States for the same variety, the Council of UPOV adopted at its twenty-first ordinary session in 1987 UPOV Recommendations on Variety Denominations.

III. CONDUCT OF EXAMINATIONS

Conduct of DUS Testing

28. DUS testing is essentially a technical examination, consisting of a field trial, sampling, observation and measurement, data processing and evaluation. All criteria are examined by observing and measuring the characteristics of a candidate variety which is cultivated in a trial field together with standard varieties. The characteristics should, in the language of the 1991 Act,

"result from a given genotype or combination of genotypes," that is to say they must be inherited.

29. The following represent fundamental aspects of DUS testing:

(i) As far as possible the result should be independent of the location of the trial and of other environmental fluctuations. Characteristics to be observed should therefore be those which are least susceptible to environmental influences. In order to minimise the influence of the environment, conditions for the test need to be precisely defined.

(ii) The genetic structure and mode of propagation of a variety should be fully taken into account. The approach to the DUS testing of vegetatively propagated, self-pollinated and cross-pollinated species and of hybrid varieties is necessarily very different.

30. Perhaps the main purpose of the UPOV Convention is to promote the protection of new varieties of plants in accordance with internationally harmonized principles. In order to realize this objective in the field of DUS testing, UPOV publishes Guidelines for the Conduct of Tests for Distinctness, Homogeneity and Stability (so-called UPOV Test Guidelines). Every year new Test Guidelines are published. Currently Test Guidelines are available for 140 different botanical genera and species. Existing Test Guidelines are revised periodically in order to reflect recent varietal changes and developments in breeding techniques. Test Guidelines are available or in preparation for the botanical genera or species listed on page 53.

31. Test Guidelines are published after they have been adopted by the Technical Committee of UPOV, which has the following Technical Working Parties "TWP's":

- Technical Working Party for Agricultural Crops ("TWA")
- Technical Working Party for Fruit Crops ("TWF")
- Technical Working Party for Ornamental Plants and Forest Trees ("TWO")
- Technical Working Party for Vegetables ("TWV")
- Technical Working Party on Automation and Computer Programs ("TWC")

32. All TWP's, with the exception of the TWC, are responsible for the preparation of Test Guidelines for individual species (the TWC deals with common matters arising from the other TWP's concerning statistical methods and computerization applicable to variety testing).

33. Each TWP consists of experts from national offices of the member States. When a TWP has decided to establish Test Guidelines for a species, it asks one of its members to prepare a discussion paper which it analyses in detail in one or more sessions. Once the TWP has completed its work, it prepares a preliminary draft Test Guidelines and distributes it to international professional organizations (International Association of Plant Breeders for the Protection of Plant Varieties (ASSINSEL), International Federation of the Seed Trade (FIS), etc.) in order to collect comments from experts other than those of national offices. The chairmen of the TWP can and do invite technical experts from such professional organizations to participate in the discussions during sessions of the Technical Working Parties. This procedure has the effect of accessing the broad knowledge and experience of breeders. The Technical Working Party subsequently rediscusses the draft of the Test Guidelines, taking account of these comments, and prepares a final draft of Test Guidelines for submission to the Technical Committee. The Technical Committee examines the

draft and, if it is approved, adopts it as official UPOV Test Guidelines for the species in question.

UPOV Test Guidelines

34. The UPOV Test Guidelines consist of the following chapters:

(i) **Subject of the Guidelines.**- This chapter indicates the applicability of the Test Guidelines document which is determined by giving the Latin name of the botanical taxon to which the Test Guidelines document is applicable. Sometimes the applicability is limited to varieties with a particular end-use or varieties with a particular method of reproduction.

(ii) **Material Required.**- This chapter specifies the quality and quantity of plant material to be submitted to the competent authorities for the purpose of the DUS testing.

(iii) **Conduct of Tests.**- This chapter specifies the conditions under which tests must be carried out, including the duration of test, the number of testing sites, the size and number of plants, etc. If the testing plants should be grown under particular conditions, e.g. under greenhouse conditions, such information is included in this chapter.

(iv) **Methods and Observation.**- This chapter contains information on how the observation of characteristics should be made, including the size of samples to be observed, the time and conditions for the observation, etc.

(v) **Grouping of Varieties.**- In the DUS trial, candidate varieties are compared with standard varieties which are deemed to be similar to them. Candidate varieties are therefore grouped together according to key characteristics which have been selected for this purpose in order to facilitate comparisons. This chapter indicates "grouping" characteristics from among the characteristics included in the Table of Characteristics.

(vi) **Characteristics and Symbols.**- This chapter gives explanations of the nature of characteristics and symbols included in Test Guidelines.

(vii) **Table of Characteristics.**- The main part of a Test Guidelines document consists of this chapter. It contains the characteristics to be observed and their states of expression, with example varieties and notes for the purpose of electronic data processing. All listed characteristics are considered to be important for distinguishing one variety from another and for the examination of uniformity and stability. The characteristics must be capable of precise recognition and description. They are enumerated in the chronological order of their observation or measurement. Performance characteristics, e.g. disease resistance and ecological characteristics, are grouped together at the end of the Table of Characteristics.

(viii) **Explanations of Characteristics included in the Table of Characteristics.**- This chapter gives any necessary detailed explanation of characteristics included in the Table of Characteristics. Explanations are especially necessary in the case of characteristics involving shape, where the state of expressions can be better defined by illustrations, or in the case of characteristics such as disease resistance where the precise conditions for testing are given so that the test can be conducted by different testing authorities under the same conditions and, in the case of resistance characteristics, by using the same race or pathotypes.

(ix) **Literature.**- This chapter gives a list of literature which was considered when the Test Guidelines document was drafted and which may be useful in relation to DUS trials.

(x) **Technical Questionnaire.**- In most member States of UPOV the applicant is required at the time of filing his application to answer technical questions given in the form of a technical questionnaire so as to give the national office a minimum amount of technical information concerning the candidate variety to assist the testing authority in designing the trial and, in particular, in choosing the standard varieties to be grown for comparison or grouping purposes next to the candidate variety. This chapter helps to ensure that the DUS trials are designed by testing authorities on a similar basis so as to facilitate the exchange of data.

Nature of Characteristics

35. The individual Test Guidelines for species should be read in conjunction with a General Introduction to Test Guidelines (document TG/1/2) which establishes broad general principles relating to testing and to the Guidelines generally. The paragraphs which follow describe certain principles of the General Introduction.

36. "Qualitative characteristics" are those which show discrete, discontinuous states with no arbitrary limit on the number of states. Some characteristics which do not fit into this definition may be handled as qualitative characteristics when the states encountered are sufficiently different from one another. Color (when the only existing states are, e.g., white and yellow), flower type (simple or double), shape of the pea seed (round or wrinkled), etc. are examples of qualitative characteristics.

37. "Quantitative characteristics" are those which are measurable on a one-dimensional scale and which show continuous variation from one extreme to the other. They are divided into a number of states for the purpose of description. Plant vigor (very weak to very strong), number of basal shoots (very few to very many), size (very small to very large), etc. are examples of quantitative characteristics.

38. Characteristics which are assessed separately may subsequently be combined, for example, the length/width ratio. Combined characteristics have to be treated in the same way as other characteristics.

Testing Distinctness

Criteria for Distinctness

39. Two varieties have to be considered distinct if the difference

- has been determined at least in one testing place,
- is clear, and
- is consistent.

Qualitative Characteristics

40. In the case of true qualitative characteristics the difference between two varieties has to be considered clear if the respective characteristics

show expressions which fall into two different states. In the case of other qualitatively handled characteristics any eventual fluctuation has to be taken into account in establishing distinctness.

Measured Quantitative Characteristics

41. When distinctness depends on measured characteristics the difference has to be considered clear, if it occurs with 1% probability of an error, on the basis of the method of the Least Significant Difference. The differences are consistent, if they occur with the same sign in two consecutive or in two out of three growing seasons. However, this rule is now being reviewed by the Technical Working Party on Automation and Computer Programs ("TWC") because a difference between varieties in a test result which just fails to achieve the 1% significance level contributes no more to the assessment of distinctness than, for instance, a zero difference in one year or even a non-significant difference of the opposite sign. In other words, such a difference is discarded for the assessment of distinctness under the current 2 x 1% rule. The TWC has devised the "Combined Over-Years Analysis" in order to overcome this problem, and the other TWP's are now discussing its usefulness for the species for which they are responsible.

Testing Uniformity

42. As mentioned in paragraph 19, uniformity should be assessed, having regard to the particular features of sexual reproduction or vegetative propagation of the variety. To be considered homogeneous, the variation shown by a variety, depending on the breeding system of that variety and off-types due to occasional mixtures, mutations or other causes, must be as limited as necessary to permit accurate description and the assessment of distinctness and to ensure stability. This requires a certain tolerance which will differ according to the reproductive system of the variety; that is whether it is vegetatively propagated, self-fertilized or cross-fertilized.

Vegetatively Propagated Varieties and Truly Self-Pollinated Varieties

43. For vegetatively propagated varieties and truly self-pollinated varieties, the following table based on existing experience indicates the maximum acceptable number of off-types in samples of various sizes.

Sample Size	Maximum Number of Off-Types
5	0
6 - 35	1
36 - 82	2
83 - 137	3

The maximum number of off-types for a sample size of more than 137 is now under discussion by the Technical Working Party on Automation and Computer Programs.

Mainly Self-Pollinated Varieties

44. Mainly self-pollinated varieties are varieties which are not fully self-pollinated but which are treated as such for testing. For these, a higher tolerance is required and the maximum number of off-types allowed in the table for vegetatively propagated varieties and for truly self-pollinated varieties is doubled.

Cross-Pollinated Varieties Including Synthetic Varieties.

45. Cross-pollinated varieties (grasses) normally exhibit wider variation within the variety than vegetatively propagated or self-pollinated varieties and it is sometimes difficult to distinguish off-types. Therefore no fixed tolerance can be determined, but relative tolerance limits are used through comparison with known comparable varieties.

46. For measured characteristics the standard deviation or variance should be used as the criterion for comparison. A variety is considered not to be homogeneous in the measured characteristics concerned if its variance exceeds 1.6 times the average of the variance of the varieties used for comparison.

47. Visually assessed characteristics have to be handled in the same way as those which are measured. The number of plants visually different from those of the variety should not significantly (by more than 5% probability of an error) exceed the number found in known comparable varieties.

Hybrid Varieties

48. Single cross varieties have to be treated as mainly self-pollinated varieties, but a tolerance has also to be allowed for inbred plants. It is not possible to fix a percentage as decisions differ according to the species and the breeding method. However, the percentage of inbred plants should not be so high as to interfere with the trials.

49. For other categories of hybrids, the segregation of certain characteristics is acceptable if it is consistent with the formula of the variety. If the inheritance of a clear-cut segregating characteristic is known, this characteristic must be treated as a qualitative characteristic. If the described characteristic is not such a clear-cut characteristic, it must be handled as in the case of other kinds of cross-pollinated varieties; that is to say, the homogeneity has to be compared with that of known comparable varieties. To establish a tolerance for inbred or parent plants, the same considerations apply as in the case of a single-cross variety.

Testing Stability

50. It is not generally possible during a period of two to three years to test stability with the same certainty as that achieved in testing for distinctness and homogeneity. Stability depends largely on the breeder's efforts to maintain the variety.

51. Generally, when a submitted sample has been shown to be homogeneous, the material can also be considered to be stable. Nevertheless, during the testing for distinctness and homogeneity, careful attention must be paid to stability. As far as necessary, stability has to be tested by growing a further generation

or new seed stock to verify that it exhibits the same characteristics as those shown by the material previously supplied.

Conduct of Examination of Other Criteria for Protection

52. While DUS testing is carried out in the form of a field trial the remaining criteria for protection, namely the commercial novelty and the appropriateness of the variety denomination, are mainly examined on the basis of information provided by the applicant and/or interested third parties.

Examination on Commercial Novelty

53. Normally it is the responsibility of the applicant (breeder) to provide evidence that the variety had not been commercialized by him or with his consent before the application was filed. The applicant may be asked to provide the competent authorities with relevant supplementary information.

54. Conversely, the competent authorities may examine the novelty of the variety ex officio by seeking out information concerning the novelty of the variety from interested circles. Once negative information concerning the novelty of the variety has been discovered by the competent authorities, the applicant is invited to present proof to the contrary; if the applicant fails to do so within a prescribed period, the application for protection will be rejected for lack of novelty.

Examination of the Variety Denomination

55. A variety denomination must, above all, be different from every denomination of an existing variety of the same species or of a closely related species. UPOV has produced a list of species which are regarded as closely related for this purpose. The examination on variety denomination accordingly consists mainly of searching for the same or similar denominations from among denominations currently in use in relation to varieties belonging to the same species or a closely related species. For this purpose the competent authorities typically collect relevant variety denominations and maintain them in their databases.

56. In order to supplement the search made ex officio by the competent authorities, all interested circles are given an opportunity to lodge an objection to a proposed variety denomination with the competent authorities prior to the formal approval of the proposed denomination.

57. In order that a variety may be protected under the same denomination in all member States of UPOV, member States exchange, pursuant to Article 13(6) of the 1978 Act of the UPOV Convention, information on variety denominations. Any authority may address its observations on the registration of a denomination to the authority which communicated that denomination.

58. Once a proposed variety denomination has been rejected by the competent authorities, the applicant is invited to provide another variety denomination within a prescribed period. If he has failed to do so, the application may be regarded as withdrawn.

The Five Criteria for Protection and Their Examination Methods

Criteria		Examination Method
Commercial novelty		Applicant's statements Information from third parties or any other source
Distinctness	DUS Testing	Field test carried out either by - the competent authorities, or - other institutes designated by the competent authorities, or - by the applicant
Uniformity	DUS Testing	
Stability	DUS Testing	
An appropriate denomination		Searching by the competent authorities of information from third parties Exchange of information between member States

Publication of Information in the Course of Examination

59. Since the interests of other parties may be affected by decisions taken in relation to applications for protection, interested parties are given an opportunity to lodge an objection with the competent authorities before the final decision on the grant of a protection title is taken. Thus in UPOV member States information on applied varieties (name of applicant/breeder, proposed denomination, description of variety, etc.) is published regularly before varieties are finally granted a protection title. Any such information offered by interested parties is also useful for the examination of the commercial novelty and distinctness of a variety and the appropriateness of any proposed variety denomination.

IV. RATIONALIZATION OF DUS TESTING

60. Expense and time is involved in the carrying out of field trials for the purpose of DUS testing: UPOV member States seek to avoid unnecessary duplication of work associated with field trials.

61. It is desirable for competent authorities which carry out extensive DUS testing to maintain or to secure the maintenance of:

- trial fields;
- well trained personnel;
- a set of the standard varieties with which candidate varieties should be compared.

Although costs can be recovered through application fees or examination fees, the task of those national authorities which choose to accept responsibility for organizing all necessary technical examination has become increasingly demanding, especially with the extension of the list of protectable plant species (for each additional protectable species it is theoretically desirable to locate or establish a collection of standard varieties). However, two solutions are available to reduce the costs of technical examination and to

facilitate the enlargement of the list of protected plant species without increasing the burden to be borne by the competent office; these are

- international cooperation in technical examination
- cooperation with breeders.

Alternative I: International Cooperation in Technical Examination

62. From the very beginning of UPOV's history, procedures have been followed to establish an international system for cooperation in examination. This international cooperation also benefits applicants seeking protection in more than one member State, who would otherwise pay examination fees for each application in each member State. International cooperation is particularly important to enable the extension of protection to plant species for which some competent authorities have perhaps not accumulated sufficient botanical knowledge or lack a collection of standard varieties for the examination.

63. International cooperation between member States often begins in the form of an exchange of varietal data and develops from bilateral cooperation to multilateral cooperation. The ultimate form of international cooperation in technical examination is a centralized testing system where all technical examinations are carried out by one authority on behalf of many other authorities for all varieties of one or more species, independent of the origin of the varieties and of their applicants. Currently, a number of multilateral arrangements exist among some European member States where one country undertakes all technical examinations on a given plant species for the other countries. The United Kingdom, for example, undertakes technical examination of all the apple varieties for Belgium, Denmark, France, Germany, the Netherlands, Sweden and Switzerland. Under a recently concluded agreement, New Zealand will provide the United Kingdom with test reports on a number of New Zealand indigenous plant species. Currently, such agreements have been concluded for 327 botanical taxa among the member States of UPOV.

64. The Council of UPOV has adopted a Model Administrative Agreement for International Cooperation in the Testing of Varieties.

65. In addition, the Office of UPOV prepares each year for the ordinary session of the Council a document summarizing the state of international cooperation in examination which indicates the names of the member States which offer their testing facilities to other member States.

66. In the technical field, the Technical Committee of UPOV has been working to harmonize testing methods among the member States of UPOV and to promote the exchange of information and the centralization of technical examinations. For this purpose UPOV not only publishes the Guidelines described above for all major plant species but has adopted the following standard forms of communication:

- the UPOV Request for Examination Results and UPOV Answer to the Request for Examination Results;
- the UPOV Report on Technical Examination and UPOV Variety Description;
- the UPOV Interim Report on Technical Examination.

UPOV is currently studying the possibility of establishing a central data base accessible either on-line or by the periodic distribution of a CD ROM product which will greatly enhance the volume and speed of data exchange, particularly in relation to denominations.

Alternative II: Cooperation with Breeders

67. Even in those countries where the competent authorities carry out official testing, breeders are required to cooperate with the competent authorities. Under Article 7(2) of the UPOV Convention and under the national plant variety protection laws, breeders are required to provide the national testing authorities with all necessary information, documents, propagating materials or seeds.

68. Cooperation with breeders can, however, take more advanced forms where the breeder of a new variety is requested to establish a trial where the candidate variety is grown together with the prescribed standard varieties. The evaluation of the variety for DUS purposes is made by an examiner of the official testing authorities in cooperation with the breeder. Data recorded by the breeder are also used for the decision of the examiner.

69. Cooperation with breeders (examiner's field inspection) is widely used, for instance, in Australia, Canada, Japan and New Zealand. This type of cooperation is particularly useful for those botanical species for which the breeding activity is limited to a few breeders who are highly specialized in a particular species. Further advantages of this approach can be seen in the case of, for example, new fruit tree varieties where the characteristics of ripe fruit can be assessed at the breeder's premises without waiting years for young seedlings provided by the breeder to bear fruit at the official testing station.

70. The testing of their own varieties by breeders has been regarded as an exception for a long time, especially in most of the European member States. The main reasons therefor were to facilitate applications by breeders (who are not usually trained taxonomists) and to maximise the legal certainty attaching to a grant of plant breeders' rights by avoiding the grant of rights for varieties on the basis of incorrect data provided by breeders. The costs of examination and the requirement of the extension of protection to further botanical taxa, which was strongly requested by breeders' organizations, has made it desirable for many UPOV member States to consider the adjustment of their former policy that all varieties should be tested by government experts. In several member States of UPOV studies are now under way to grant plant breeders' rights on the basis of the results of examinations carried out by the breeder but subject to strict conditions designed to ensure that the legal certainty attached to grants of protection in the UPOV system is maintained.

71. The 1991 Act of the UPOV Convention will, when it comes into force, oblige existing member States which accede to it to protect all plant genera and species at the latest after the expiration of a period of five years from the date of becoming bound by the said Act. Some form of cooperation between breeders and competent authorities in the testing of varieties for DUS seems likely to play an important role in enabling countries to accept this obligation of the 1991 Act of the Convention.

ANNEX

REFERENCE NUMBERS OF TEST GUIDELINES IN ALPHABETICAL ORDER OF THEIR ENGLISH NAMES

African Violet	TG/17
Almond	TG/56
Alstroemeria	TG/29
Anthurium	TG/86
Apple	TG/14
Apricot	TG/70
Artichoke	-
Asatsuki	-
Asparagus	TG/130
Aster	TG/141
Avocado	TG/97
Banana	TG/123
Barley	TG/19
Beetroot	TG/60
Bent	TG/30
Berberis	TG/68
Black Currant	TG/40
Black Radish	TG/63
Black Salsify	TG/116
Blackberry	TG/73
Blueberry	TG/137
Broad Bean	TG/08
Broccoli	-
Brussels Sprouts	TG/54
Bunching Onion	-
Cabbage	TG/48
Cardoon	-
Carnation	TG/25
Carrot	TG/49
Cauliflower	TG/45
Celeriac	TG/74
Celery	TG/82
Chamomile	-
Cherry	TG/35
Chestnut	TG/124
Chick-Pea	TG/143
Chicory	-
Chinese Cabbage	TG/105
Chincherinchee	TG/131
Chives	-
Chokeberry	-
Christmas Cactus	TG/101
Chrysanthemum	TG/26
Citrus	TG/83
Cocksfoot	TG/31
Common Vetch	TG/32
Cornsalad	TG/75
Cotton	TG/88
Crown of Thorns	TG/91
Cucumber	TG/61
Cucurbita maxima	-
Cucurbita moschata	-
Curly Kale	TG/90
Cymbidium	-
Daffodils	TG/87
Dieffenbachia	TG/132
Dill	-
Durum Wheat	TG/120
Easter Cactus	TG/113
Egg Plant	TG/117
Elatior Begonia	TG/18
Endive	TG/118
Euphorbia Fulgens	TG/10
European Plum	TG/41
Evening Primrose	TG/144
Exacum	TG/114
Field Bean	TG/08
Firelily	-
Firethorn	TG/147
Flax	TG/57
Fodder Beet	-
Forsythia	TG/69
Freesia	TG/27
French Bean	TG/12
Garlic	-
General Introduction	TG/01
Gentian	TG/145
Geralton Wax Flower	-
Gerbera	TG/77
Gherkin	TG/61
Gladiolus	TG/108
Gooseberry	TG/51
Grapefruit	TG/83
Groundnut	TG/93
Guava	TG/110
Hard Fescue	TG/67
Hazelnut	TG/71
Hot Pepper	TG/76
Hydrangea	TG/133
Ifafa Lily	-
Impatiens	TG/102
Iris	-
Ivy-leaved Pelargonium	TG/28
Japanese Apricot	-
Japanese Pear	TG/149
Japanese Plum	TG/84
Jostaberry	TG/138
Juniper	TG/103
Kalanchoe	TG/78
Kangaroo Paws	-
Kentucky Bluegrass	TG/33
Kiwifruit	TG/98
Kohlrabi	TG/65
Lachenalia	TG/126
Lagerstroemia	TG/95
Lavender	-
Leaf Beet	TG/106
Leek	TG/85
Lemons	TG/83
Lettuce	TG/13
Leucadendron	TG/127
Leucospermum	TG/128
Lily	TG/59
Ling	TG/94
Lingonberry	TG/139
Linseed	TG/57
Loquat	-
Lucerne	TG/06
Lupins	TG/66
Macadamia	TG/111
Maize	TG/02
Mandarins	TG/83
Mango	TG/112
Meadow Fescue	TG/39
Melon	TG/104
Narcissi	TG/87
Nerine	TG/146
Norway Spruce	TG/96
Oats	TG/20
Olive	TG/99
Onion	TG/46
Oranges	TG/83
Paprika	TG/76
Parsley	TG/136
Peach	TG/53
Pear	TG/15
Pear Rootstocks	-
Peas	TG/07
Persimmon	TG/92
Pistache	-
Poinsettia	TG/24
Poplar	TG/21
Pot Azalea	TG/140
Potato	TG/23
Protea	TG/129
Prunus rootstocks	-
Pumpkin	-
Pyracantha	TG/147
Quince	TG/100
Radish	TG/64
Rape	TG/36
Raspberry	TG/43
Red cabbage	TG/48
Red Clover	TG/05
Red Currant	TG/52
Red Fescue	TG/67
Regal Pelargonium	TG/109
Rhododendron	TG/42
Rhubarb	TG/62
Rice	TG/16
Rose	TG/11
Runner Bean	TG/09
Rye	TG/58
Ryegrass	TG/04
Safflower	TG/134
Savoy cabbage	TG/48
Scorzonera	TG/116
Scotch Heather	TG/94
Sea Lavender	-
Serruria	-
Shallot	-
Sheep's Fescue	TG/67
Sorghum	TG/122
Soya Bean	TG/80
Spathiphyllum	TG/135
Spinach	TG/55
Squash	TG/119
Statice	-
Strawberry	TG/22
Streptocarpus	TG/47
Sunflower	TG/81
Swede	TG/89
Sweet Pepper	TG/76
Tall Fescue	TG/39
Thyme	-
Timothy	TG/34
Tomato	TG/44
Triticale	TG/121
Tuberous Begonia	TG/107
Hybrids	-
Tulip	TG/115
Turnip	TG/37
Turnip Rape	TG/37
Vegetable Marrow	TG/119
Vine	TG/50
Walnut	TG/125
Watermelon	TG/142
Weigela	TG/148
Welsh Onion	-
Wheat	TG/03
White cabbage	TG/48
White Cedar	TG/79
White Clover	TG/38
White Currant	TG/52
Willow	TG/72
Witlof	-
Zonal Pelargonium	TG/28

THE 1991 ACT OF THE UPOV CONVENTION

1. The International Convention for the Protection of New Varieties of Plants ("the UPOV Convention") was concluded in Paris in 1961, was revised at Geneva in 1972 and 1978 and was further revised at a Diplomatic Conference held in Geneva from March 4 to 19, 1991. The following 22 States are party to the 1978 Act of the UPOV Convention ("the 1978 Act"): Australia, Canada, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Israel, Italy, Japan, the Netherlands, New Zealand, Norway, Poland, Slovakia, South Africa, Sweden, Switzerland, the United Kingdom and the United States of America. Belgium and Spain are party only to the 1961 Act. On September 13, 1993, there are accordingly 24 member States of the International Union for the Protection of New Varieties of Plants. However, several States have recently enacted laws which accord with the UPOV Convention, while many other countries are currently studying the UPOV system of plant breeders' rights which has become the most widely recognized system for providing industrial property protection for plant varieties.

2. Advances in technology and the experience of operating the Convention since 1961 led to a number of suggestions for improvements to the Convention. Accordingly, in 1987, the Council of UPOV decided to put in hand the work necessary to effect a revision of the 1978 Act. A meeting of UPOV with international non-governmental organizations (in effect a hearing at which the Council of UPOV listens to the views of international non-governmental organizations on a particular topic) had already been held in 1987 on possible changes to the Convention and influenced the decision of the Council to commence work on a revision. There followed two further meetings with international non-governmental organizations in 1989 and 1990 and seven working sessions in 1988, 1989 and 1990 of the Administrative and Legal Committee of UPOV which was charged by the Council with the task of preparing a draft of a revised Convention. The Council adopted in October 1990 a draft revised Convention ("the Basic Proposal") and decided to hold a Diplomatic Conference in March 1991 to revise the Convention.

3. In addition to the, then 20, member States of UPOV, some 30 observer States participated in the Conference, as well as 24 intergovernmental and non-governmental observer organizations. In excess of 130 proposals for amendments to the Basic Proposal were considered by the Conference which finally adopted unanimously on March 19, 1991, a revised 1991 Act of the UPOV Convention ("the 1991 Act"). Fifteen member States of UPOV signed the 1991 Act either at the conclusion of the Conference or during the period when it remained open for signature. The effect of signature is not, of course, to bind the signatory State but simply represents an acknowledgment of its intention to enact a law based on the Convention and, in due course, to ratify the Convention. It is only the ratification of the Convention by an existing member State which has signed the Convention, or accession to the Convention by a new member State, which creates an international legal obligation.

4. Article 37 of the 1991 Act provides that it will come into force one month after five States have deposited their instruments of adherence, provided that at least three of such instruments are deposited by existing member States of UPOV. After the entry into force of the 1991 Act, the 1978 Act will, in principle, be closed to further accessions.

5. However, two "periods of grace" have been incorporated into the 1991 Act. The 1978 Act will remain open for accession by developing countries until December 31, 1995, and by any other country until December 31, 1993. The

period of grace in favor of developing countries recognizes the fact that there is a sea change in attitude amongst developing countries in relation to the protection of plant varieties, but that it will take some time for those countries currently expressing interest to actually introduce legislation. It was thought that whilst the 1978 Act is now of great interest to many developing countries as a basis for national legislation, the 1991 Act might in some cases require further study prior to its incorporation into the national laws of some developing countries. The period of grace in favor of developing countries in no way implies that the new Act was not suitable for developing countries. On the contrary, the provisions relating to essentially derived varieties, for example, are of fundamental inportance for developing countries. The period of grace for other countries takes account of the fact that a number of States have already initiated proposals for legislation upon the basis of the 1978 Act, and the grace period until December 31, 1993, should enable them to finalize their legislative activity and accede to the Convention on the basis of the 1978 Act.

6. Article 34(1)(b) of the 1991 Act provides for possible membership of UPOV by an intergovernmental organization. This provision is designed to open the possibility of membership by the European Economic Community if and when the proposal for the Council Regulation (EEC) on Community Plant Variety Rights is adopted by the Community. Article 26(6)(b) which concerns voting in the Council, and Article 6(3) and 16(3) concerning novelty and exhaustion also contain provisions which reflect the interests of the Community.

7. The structure of the 1978 Act was fundamentally revised in the new Act. In the 1991 Act, the articles are grouped together in ten chapters and the chapters follow a chronological order dealing first with the "General Obligations of the Contracting Parties," followed by "Conditions for the Grant of the Breeder's Right," provisions concerning the "Application for the Grant of the Breeder's Right," "The Rights of the Breeder," "Variety Denomination" and "Nullity and Cancellation of the Breeder's Right." The administrative and final provisions of the Convention are contained in the last three chapters.

8. The remainder of this paper examines the text of the 1991 Act in the numerical order of the articles, mentioning the corresponding articles in the old text and the nature of the changes. No attempt is made to deal with every article or with every paragraph of every article. Only those which are of major importance from the substantive standpoint are addressed.

Article 1 - Definitions

9. Article 1 contains "definitions" which are, for the most part, self-explanatory. Item (vi) contains a definition of "variety." The 1978 Act contains no definition of "variety" while the 1961 Act of the Convention provides that "For the purposes of this Convention, the word "variety" applies to any cultivar, clone, line, stock or hybrid which is capable of cultivation and which satisfies the provisions of subparagraph (1)(c) and (d) of Article 6." The provisions of these subparagraphs specify the conditions of homogeneity and stability which must be satisfied by a plant variety prior to a grant of breeders' rights. Whether a definition was necessary in the Convention at all was much discussed during preparations for the revision; patent circles, having earlier favored the introduction of a definition which would be the same for the purposes of patenting as for the purposes of plant variety protection, had more recently begun to suggest that a definition was unnecessary. It seems that patent circles were concerned that the definition of "variety" might embrace a plant cell line and that the exclusion provisions of Article 53(b) of the European Patent Convention, which exclude plant varieties from patent-

ing, might be interpreted in the light of the new definition so as to exclude a plant cell line from patenting.

10. The definition of "variety" incorporated into the 1961 Act of the Convention is almost, but not quite, synonymous with "variety which is protectable under the Convention." In framing a definition in 1991, it was thought that there should be a clear distinction between the definition of "variety" and a variety which meets the technical criteria of Articles 7, 8 and 9 of the 1991 Act of the Convention so as to be a protectable variety. This is to ensure that a variety with a level of uniformity which is unacceptable for the purposes of a grant of rights may still exist as a "variety" and be taken into account, for example, for the purposes of common knowledge and distinctness under Article 7. The fact that the definition of "variety" is wider than "protectable variety" is made clear by the use of the words "irrespective of whether the conditions for the grant of a breeder's right are fully met" in the introductory phrase.

11. In order to establish an identity for any variety, protectable or otherwise, it must be distinct from other varieties, certain characteristics must be displayed with reasonable uniformity by its component individuals, and it must retain its identity from one generation to the next. The conditions of distinctness, uniformity and stability which are necessary for the purposes of establishing an identity for a unit of plant material to which breeders' rights are to attach, are thus also necessary, but possibly to a more limited extent, when deciding that particular plant material constitutes a variety. The three indents in the definition correspond respectively to the requirements for uniformity, distinctness and stability but were considered to set these requirements at a lower level than that necessary for protection.

12. The expression "plant grouping" used within the definition corresponds to the French "ensemble végétal" and leaves open the question whether a variety must invariably be constituted by more than one whole plant.

Article 2 - The Basic Obligation of Contracting Parties

13. The basic obligation of States party to the Convention that "each Contracting Party shall grant and protect breeders' rights" is imposed by Article 2. "Breeder's right" is defined in Article 1 as "the right of the breeder provided for in this Convention." Accordingly, each State party to the Convention must grant protection on the conditions specified in Chapter III (and subject to no further and different conditions), with the minimum scope of protection required by Chapter V, and in accordance with all other relevant provisions of the Convention. The provisions of Article 2 correspond to the provisions of Articles 1 and 30(3) of the 1978 Act.

14. Unlike the first sentence of Article 2(1) of the 1978 Act, the 1991 Act is silent on the form of the breeder's right. It may take the form of a special sui generis breeder's right, or it may be called a "patent" or given any other designation provided it has the minimum substance provided for in the Convention. The 1991 Act equally contains no provision corresponding to the second sentence of Article 2(1) of the 1978 Act (the so-called "ban on double protection") so that a Contracting Party is, so far as the 1991 Act is concerned, free to protect varieties, in addition to the grant of a breeder's right, by the grant of other titles, particularly patents. A member State exercising this freedom to grant patents in addition to the breeder's right is free to decide whether an applicant must choose between a breeder's right and a patent, that is, if he applies for one, he cannot apply for the other, or

whether he can apply for and be granted both the breeder's right and the patent. If, for any given variety, cumulative protection of this kind is obtained, the resolution of any conflict between the two kinds of protection is left to the legislation and courts of the member State where the titles were obtained and is not regulated by the Convention.

Article 3 - Genera and Species to be Protected

15. Article 3 corresponds to Article 4 of the 1978 Act and is concerned with the genera and species to be protected. The system of the 1978 Act is to require member States to protect a minimum of five genera or species on accession to the Convention, and to require that thereafter member States protect genera or species on a progressive basis, leading to a minimum of 24 genera or species after eight years. Article 4 of the 1978 Act does contain a provision that member States should undertake to adopt all measures necessary for the progressive application of the Convention to the largest possible number of botanical genera and species, but in no way imposes on member States a clear commitment to protect the whole plant kingdom. Article 3 of the 1991 Act, however, requires existing member States to protect all plant genera and species five years after becoming bound by the new text and requires new member States to protect all plant genera and species ten years after they become bound by the 1991 Act, so that over time a worldwide UPOV system of plant variety protection will emerge which requires all member States to protect all plant genera or species.

16. The emergence of such a system has some interesting implications for the future, particularly in view of the increased scope of protection which is now provided in Article 14 of the new text. If Sweden, for example, decides to modify its national law and to ratify the 1991 Act, it should in due course become possible to protect a new banana variety in Sweden, notwithstanding the fact that the variety will never be grown there, but with a view to taking action against imports derived from the unlicensed propagation of the variety in countries where plant variety protection is not available. Thus far, Sweden, as an importing country, has probably been uninterested in the protection of bananas. The absence of any protection of the harvested material of a plant variety in importing countries has meant that it has also been a matter of no concern to exporting countries without breeders' rights if varieties were piratically exploited in their territories with no reward to the breeders of the varieties. This situation may well change in the future in relation to species where the harvested material of the variety moves in international trade.

Articles 5, 6, 7, 8 and 9 - Conditions for the Grant of the Breeder's Right

17. These articles contain the conditions for the grant of a breeder's right and correspond to Article 6 of the 1978 Act of the Convention. There have been extensive changes in language but, except where some express reference is made below, there is no specific intention to change the substance.

18. Article 6 of the new text deals with the novelty-destroying prior commercialization of a variety. In the existing text, a variety must not have been offered for sale or marketed with the agreement of the breeder prior to the filing of an application for protection in the territory where the application is filed or, where the law of the relevant State so provides, for one year prior to such filing. The new text requires all member States to make provision in their laws for this one-year grace period; it is no longer optional.

19. The provisions of Article 6(1)(b) of the 1978 Act state that the variety must not have been offered for sale or marketed with the agreement of the breeder prior to the date of application. The provisions of Article 6 of the 1991 Act state that propagating or harvested material of the variety must not have been sold or otherwise disposed of to others by or with the consent of the breeder for the purposes of exploitation of the variety. The language of the 1991 Act is very different from that of Article 6(1)(b) of the 1978 Act and may have the effect of catching certain commercial activities with varieties that fall outside the corresponding provisions in the existing laws of some UPOV member States. An example might be the use of an inbred line as the parent of a hybrid where the inbred line was not itself sold or marketed. It has been claimed that the use of an inbred in this way, perhaps protected by trade secrecy, would not debar its breeder from applying for protection for the inbred line many years after it was first used for commercial purposes.

20. Paragraph (3) of Article 6 of the 1991 Act makes reference to special rules that may be adopted where sales are effected in the member States of an intergovernmental organization. This provision relates to the possible future UPOV membership of the EEC, and enables the EEC and its member States to enact provisions which will make a sale in one EEC member State a novelty-destroying event for all EEC member States so as to conform with the concept of the single market.

21. Article 7 of the 1991 Act deals with distinctness and requires simply that a variety must be clearly distinguishable from any other variety whose existence is a matter of common knowledge at the time of the filing of the application. The language of the existing text, by which a variety must be clearly distinguishable by one or more important characteristics from any other variety, has been abandoned since it was thought to be needlessly ambiguous. The word "important" has frequently suggested to persons reading the text of the 1978 Act for the first time that a variety must, to be protectable, be distinct from existing varieties by some feature related to merit. This has never been the case. The UPOV Convention affords protection to any variety which is clearly distinguishable from other varieties irrespective of any judgment concerning its worth. The view has been consistently taken over the years in UPOV circles that the worth or merit of a variety varies too greatly with time and environment to be used as a criterion for the grant of protection in an international intellectual property rights' system. The simplified new text avoids the ambiguity of the word "important."

22. The 1978 Act provided a non-exhaustive list of examples of common knowledge which included "an entry in an official register of varieties already made or in the course of being made," which plainly does not constitute common knowledge in the normal sense since the relevant information may not necessarily be publicly available. Accordingly, Article 7 in the new text leaves the notion of common knowledge undefined and refers only to the specific instances of applications for protection or entry in an official register where, for the purposes of the Convention, common knowledge is deemed to exist notwithstanding that the information may not be generally available.

23. An application for the grant of a breeder's right or for the entering of a variety in an official register of varieties does not, however, make the variety in question a matter of common knowledge unless the application leads to the granting of a breeder's right or the entering of the variety in an official register of varieties. This is to avoid a situation where the system becomes cluttered with large numbers of "varieties" which were the subject of applications which have been refused or withdrawn and which no longer exist since they have been discarded by their breeders.

24. The language of Articles 8 and 9 of the 1991 Act, dealing with uniformity and stability respectively, is different from that in the corresponding provisions of the 1978 Act but there is no intended change in substance.

Article 12 - Examination of the Application

25. Article 12 of the 1991 Act deals with the examination of the application and corresponds to Article 7 of the 1978 Act. There is some change of emphasis in the new text in that it expressly makes reference to the authority responsible for the test "taking into account the results of growing tests or other trials which have already been carried out." The eventual extension of protection to the whole plant kingdom under Article 3 of the 1991 Act will mean that examining authorities may be called upon to examine plant varieties of any species for distinctness, uniformity and stability, including species which are rare or unknown or in relation to which the authority has little or no knowledge or experience. Clearly in these circumstances, the authority may not itself be in a position to conduct the necessary tests and may find it necessary to ask the breeder to conduct tests or to take into account data which has been generated by the breeder. In cases of this kind, tests conducted by the breeder may well be acceptable provided that the data in question is presented in a common format and is generated by tests which follow the principles established in the General Introduction to the UPOV Guidelines for the Conduct of Tests for Distinctness, Uniformity and Stability, and that a sample of the variety is made available to the authority at the date of application.

Article 13 - Provisional Protection

26. Provisional protection is dealt with in Article 7(3) of the 1978 Act which does not, however, make it obligatory for member States to provide provisional protection. Article 13 of the 1991 Act, however, obligates member States to make provision for protecting the interests of the breeder during the period between the filing or the publication of an application and the subsequent grant. The Article requires Contracting Parties to ensure that, as a minimum, the holder of the breeder's right should be entitled to equitable renumeration in respect of acts which will require the breeder's authorization once the right has been granted. The Article reflects the present practice of some countries by permitting Contracting Parties to provide that the provision of protection shall only take effect in relation to persons whom the breeder had notified of the filing of the application.

Article 14 - Scope of the Breeder's Right

27. Article 5 of the 1978 Act provides that the prior authorization of the breeder "shall be required for:

- the production for purposes of commerical marketing,
- the offering for sale,
- the marketing

of the reproductive or vegetative propagating material, as such, of the variety." The article further provides that "vegetative propagating material shall be deemed to include whole plants" and that "the right of the breeder shall extend to ornamental plants or parts thereof, normally marketed for purposes other than propagation, when they are used commercially as propagating material in the production of ornamental plants or cut flowers."

28. The fact that the breeder's authorization is only required for the production of propagating material "for purposes of commercial marketing" means that production of propagating material that is not intended for marketing, but only for use on the farm where it was produced, falls outside the scope of protection. This has the effect of creating implicitly the so-called "farmer's privilege" whereby farmers may replant on their farms propagating material from the previous year's harvest.

29. Article 14(1) of the 1991 Act provides that, in respect of the propagating material of a protected variety, any production, reproduction (multiplication), conditioning for the purpose of propagation, offering for sale, selling or other marketing, exporting, importing, or stocking for any of these purposes, shall require the authorization of the breeder. Accordingly, the basic scope of the protection extends to all production or reproduction (multiplication) without a reference to its purpose and, unlike the 1978 Act, does not have the effect of creating, by implication, a "farmer's privilege."

30. The very widely differing natures of the agricultural industries of UPOV member States and the varying political situations in these States have nonetheless made it essential to include in the new Act a provision entitling States on an optional basis to except the planting of farm-saved seed from the requirement for the breeder's authorization. The provision in question is contained in Article 15(2). It provides that "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." The structure of the provision should ensure that countries give careful thought to the interests of plant breeders when exercising this option. It is hoped that States will examine the issues involved on a species by species basis. The Diplomatic Conference formally recommended that the provision of Article 15(2) "should not be read so as to be intended to open the possibility of extending the practice commonly called "farmer's privilege" to sections of agricultural or horticultural production in which such a privilege is not a common practice."

31. Apart from the special provision relating to the production of ornamental plants or cut flowers, the mandatory minimum scope of protection under Article 5 of the 1978 Act is limited to the reproductive or vegetative propagating material, as such, of the variety. Paragraph (4) of Article 5 does provide that member States may grant to breeders, in respect of certain botanical genera or species, a more extensive right than that otherwise provided in Article 5, extending, in particular, to the marketed product. Few States have taken advantage of this optional provision. A major question debated in the course of the revision process was whether the scope of the breeder's right should be extended in a more general way to the harvested material of the protected variety or to products produced by processing the harvested material.

32. The Diplomatic Conference decided the above question positively. Article 14(2) of the 1991 Act does make provision for the scope of the breeder's right to extend to harvested material including entire plants and parts of plants where these have been obtained through the unauthorized use of propagating material of a protected variety, but qualifies the scope by providing that this scope of protection exists, "unless the breeder has had reasonable opportunity to exercise his right in relation to the propagating material of the variety."

33. The majority of the member States of UPOV who voted in the Diplomatic Conference on the text of Article 14(2) were not prepared to extend to the breeder an untrammeled choice between the exercise of his right in relation to the propagating material and its exercise in relation to the harvested material. They were not, for example, prepared to permit the breeder to be totally free to exercise his intellectual property right over the grain instead of the seed. There was, however, general agreement in the Diplomatic Conference that a breeder needed to have a right exercisable over the harvested material of his variety when he had had no opportunity to exercise a right in relation to the propagating material. The most commonly quoted example of the breeder being unable to exercise his right was that of the piratical use of a breeder's variety in another country, perhaps a country which makes no provision for plant variety protection, followed by a subsequent import of harvested material of the variety into a country where the variety is protected. A further example would be the exercise by the breeder of his right in relation to any harvested material which arises from an infringement, of which he was unaware, of his rights in respect of propagating material.

34. Article 14(2) provides that the breeder has a right to protection in relation to harvested material "unless he has reasonable opportunity to exercise his right in relation to the propagating material." Accordingly, it is the alleged infringer who will usually bear the burden of establishing that the breeder has indeed had reasonable opportunity to exercise his right in relation to the propagating material of the variety.

35. Article 14(3) of the 1991 Act provides for the further extension of the right of the breeder to products made directly from harvested material. This provision is not, however, part of the mandatory minimum scope of protection under the 1991 Act. States adhering to the 1991 Act may choose whether they wish to extend the breeder's right in accordance with Article 14(3). Under the Article, the authorization of the breeder is required to produce, sell, market, etc. any product made directly from harvested material, provided that the harvested material itself results from infringement. Once again, the exercise by the breeder of any right under the Article in relation to products made directly from harvested material exists "unless the breeder has had reasonable opportunity to exercise his right in relation to the harvested material." The provisos attached to Article 14(2) and (3) together constitute what has been called a "cascade." The idea of those who promote the notion of a cascade is that the breeder should only exercise his right in relation to harvested material if he has not been able to exercise it in relation to the propagating material and that he should only exercise his right in relation to a product made directly from harvested material if he has been unable to exercise his right in relation to the harvested material.

36. As already mentioned, interesting future consequences arising from the extended scope of protection in the 1991 Act can be envisaged once protection extends to the whole plant kingdom.

Article 14(5) - Essentially Derived Varieties

37. Under the provisions of Article 6(1)(a) of the 1978 Act, any variety is protectable which, inter alia, is clearly distinguishable, at the time of application, by one or more important characteristics from other commonly known varieties and which is sufficiently uniform and stable. Article 5(3) of the 1978 Act provides that a protected variety may be used as an initial source of variation for the purpose of creating other varieties. The two provisions taken together create a situation in which an existing protected variety may

be used as a source of initial variation and a variety selected therefrom may be freely exploited by the selector free of any obligation to the breeder of the protected variety, provided that the selection is clearly distinguishable by one or more important characteristics from the protected variety. Since the word "important" in this context has been construed to mean "important for the purposes of making a distinction" and not "important in the sense of having value," this has meant that a person selecting a mutant or a minor variant from an existing variety or inserting an additional gene into it by back-crossing or some other procedure can protect the resulting variety without rewarding the original breeder for his contribution to the final result. Typical examples are the selection of a color mutant from an ornamental variety, the insertion of a single gene into a maize line by back-crossing (under the favorable conditions of the tropics, multiple back-crosses can be effected in one year) and more recently, the insertion of a single gene by genetic engineering. The fact that the 1978 Act does not enable the breeder to prevent breeding approaches of this kind has been criticized as unjust by industrial circles and the 1991 Act remedies this situation by introducing the principle of "essential derivation." Article 14(5) of the 1991 Act provides that a variety which is essentially derived from a protected variety cannot be exploited without the authorization of the breeder of the protected variety. A variety is deemed to be essentially derived from another variety ("the initial variety") for this purpose when

> "(a) it is predominantly derived from the initial variety or from a variety that is itself predominantly derived from the initial variety while retaining the expression of the essential characteristics that result from the genotype or combination of genotypes of the initial variety;
>
> (b) it is clearly distinguishable from the initial variety;
>
> (c) except for the differences which result from the act of derivation, it conforms to the initial variety in the expression of the essential characteristics that result from the genotype or combination of genotypes of the initial variety."

38. Article 14(5) provides a non-exhaustive list of examples of acts that may result in essential derivation including the selection of a natural or induced mutant, or of a somaclonal variant, the selection of a variant individual from plants of an initial variety, back-crossing, or transformation by genetic engineering.

39. It is not envisaged that a determination concerning the essential derivation of a variety will be made by an examining office as part of the grant procedure, but rather that the question will be resolved between plant breeders by agreement or in the last resort through litigation.

40. The existence of the new principle should ensure in future that those working as innovators in the field of plants will reach agreement before they undertake a program of activity which could result in varieties that are essentially derived from protected varieties. It is hoped that in the vast majority of cases amicable arrangements will be made between plant breeders and/or biotechnologists. If a plant breeder inserts a gene falling within the claims of an invention relating to genetic information (a "patented gene") into his variety, the resulting variety could fall within the scope of the patent enabling the patentee, in effect, to prohibit the exploitation of the variety. If, on the other hand, the patentee inserts the patented gene into the same variety, the breeder of the variety has no possibility at present to

forbid the exploitation of the modified variety. In future, if a patentee of a gene inserts his patented gene into a protected variety, there will exist the possibility that the modified variety will be essentially derived and fall within the scope of protection of the protected variety. It is thought that the new balance established between the two systems in this way will facilitate the exchange of technology between plant breeders and biotechnologists. Plant breeders and biotechnologists are described here as if they pursue fundamentally separate activities. UPOV is well aware that their activities may be pursued in one and the same organization or by one person but it does still help, occasionally, for present purposes to talk of the two activities separately. It should be noted that there is no suggestion in the essential derivation provision that the breeder of an essentially derived variety should be able to force the breeder of the initial variety to grant a license through some compulsory license procedure. This possibility was considered and rejected in the course of the revision process.

Article 15 - Exceptions to the Breeder's Right

41. A description has already been given, in connection with the scope of protection, of the provisions of Article 15(2) relating to an optional exception from the scope of protection in favor of certain farmers in certain circumstances. Article 15(1)(iii) provides that "acts done for the purpose of breeding other varieties" are compulsorily excepted from the breeder's right. This provision reproduces the substance of Article 5(3) of the 1978 Act whereby the authorization of the breeder is not required for the utilization of a protected variety as an initial source of variation for the purpose of creating other varieties, thus creating the so-called "breeder's exemption." This is a very important feature of the Convention and is strongly supported by plant breeders and by interested circles generally. The breeder's exemption principle was strongly reaffirmed by the Diplomatic Conference. Some parties have sought to suggest that the introduction of the principle of essential derivation represents a fundamental departure from the breeder's exemption. Essential derivation is not seen in this light in UPOV. A variety will be essentially derived from another only when it retains the expression of the essential characteristics that result from the genotype or combination of genotypes of the initial variety. Accordingly, a variety will only be caught by the essential derivation provision when it resembles the initial variety very closely and uses virtually the whole genetic structure of the initial variety apart from specific limited modifications. Any variety may still be used under the 1991 Act of the Convention for the purpose of breeding other varieties and, unless they fall within the limited category of varieties which are essentially derived, such newly bred varieties may be freely exploited. The nature of the essential derivation principle is such that any breeder who embarks upon a program which will result in a variety which is essentially derived, will know what he is doing and why he is doing it and will either reach agreement with the breeder of the initial variety or will take the risk that the time and effort of his program will be wasted if the breeder of the initial variety declines to grant a license.

42. The new principle is seen in UPOV circles as an important extension of the zone of protection around a protected variety. This zone will in future comprise the minimum distance that results from the existing distinctness rule together with an additional zone created by the essential derivation principle.

Article 16 - Exhaustion of the Breeder's Right

43. The breeder's right does not extend to acts concerning any material of the protected variety which has been sold or otherwise marketed by the breeder or with his consent, unless such acts

(i) involve further propagation of the variety, or

(ii) involve an export of material of the variety, which enables the propagation of the variety, into a country which does not protect varieties of the plant genus or species to which the variety belongs, except where the exported material is for final consumption purposes.

The breeder's right to prohibit propagation of the variety is thus never exhausted.

Article 19 - Duration of the Breeder's Right

44. Article 19 adjusts the minimum period of the breeder's right from 18 years for trees and vines and 15 years for all other species to periods of 25 years and 20 years respectively for these same categories. In large measure, these adjustments reflect the existing practice of member States. The substitution of the 20-year period for the 15-year period of protection will have the effect that the period of protection available for the majority of applicants in the plant breeders' rights system will be the same as that available in the patent system.

Administrative and Final Provisions

45. For the most part, the administrative and final provisions of the 1991 Act, which are contained in Articles 21 to 42, reproduce the substance of the 1978 Act.

46. Article 35 of the 1991 Act is worthy of comment. It provides that any State which, at the time of becoming a party to the 1991 Act, is a party to the Act of 1978 and which, as far as varieties reproduced asexually are concerned, provides for protection by an industrial property title other than a breeder's right shall have the right to continue to do so without applying this Convention to those varieties. This provision is designed, as was Article 37 of the 1978 Act, specifically for the situation of the United States of America, which protects asexually reproduced plant varieties, other than potatoes and Jerusalem artichokes, by a special form of plant patent (which does not strictly accord with the provisions of the UPOV Convention) and which protects sexually reproduced varieties (other than hybrids) by the Plant Variety Protection Act (which does accord with the provision of the UPOV Convention). Accordingly, unless the United States of America changes its law rather fundamentally, it will not be in a position to meet the requirements of Articles 2 and 3 which will ultimately require it to grant and protect breeders' rights (that is rights which accord with the UPOV Convention) for all plant genera and species. Article 35 of the 1991 Act, which can only apply to the United States of America, enables it in large measure to continue with its present system, unless or until, of course, it decides to rationalize the present provisions of its law.

THIRD SESSION

SELECTED TOPICS ON PLANT VARIETY PROTECTION

PLANT VARIETY PROTECTION IN THE NETHERLANDS - THE EUROPEAN APPROACH TO PLANT VARIETY PROTECTION

Speaker: Mr. Bart P. Kiewiet, President, Board of Plant Breeders' Rights, Wageningen, Netherlands

PLANT VARIETY PROTECTION IN CANADA - THE EXPERIENCE OF A NEW MEMBER STATE OF UPOV

Speaker: Mr. Grant Watson, Acting Commissioner, Plant Breeders' Rights, Plant Products Division, Ottawa, Canada

THE TESTING OF FLOWER VARIETIES IN JAPAN

Speaker: Mr. Kôji Kanazawa, Examiner, Seeds and Seedlings Division, Ministry of Agriculture, Forestry and Fisheries, Tokyo, Japan

PLANT VARIETY PROTECTION IN THE FLOWER BUSINESS

Speaker: Mr. Yoshito Iwasa, Senior Managing Director, Sakata Seed Corp., Yokohama, Japan

Chairman: Dr. Manuel L. Logroño, Institute of Plant Breeding, University of the Philippines, Los Baños College, Laguna, Philippines

PLANT VARIETY PROTECTION IN THE NETHERLANDS -
THE EUROPEAN APPROACH TO PLANT VARIETY PROTECTION

Mr. Chairman, Ladies and Gentlemen,

1. I am honored to have the opportunity to participate in this Seminar. I will give you some information on the historical and actual situation in my country regarding plant variety protection ("PVP"). Additionally I will inform you on recent developments in this field within the European Economic Community, of which the Netherlands, as you will know, is a member.

2. Although the Netherlands is a relatively small country, certainly compared to the People's Republic of China, it plays a major role in the world of plant breeding. In the case especially of vegetables, ornamentals and agricultural crops like fodder grasses and potatoes, breeding companies in the Netherlands have developed varieties that are used by farmers in many parts of the world. We have breeding companies of all sizes, from small family enterprises to big multinational companies with subsidiary companies in many countries.

3. To create new varieties the breeder must invest time and money. Successful breeders desire a reasonable financial return on their investments. This is only fair. Without financial compensation for their labor, the incentive for breeders to develop valuable new varieties would rapidly disappear. In the long run this would have very negative consequences for agricultural production. The development of new varieties is necessary to cope with the ever-increasing and changing demand for agricultural products.

4. The idea that the breeder should be given a form of legal protection, in order to enable him to have a financial return on his investment, led the Netherlands in 1941, after long discussions, to adopt a law offering the possibility of protecting new varieties by means of a form of plant breeder's right ("PBR"). After the coming into force of the UPOV Convention of 1961, the national legislation of the Netherlands was adapted to that Convention. The present law dealing with PBR is based on the 1978 Act of the UPOV Convention. We are preparing legislation to bring the Netherlands' law in line with the UPOV Convention of 1991.

5. If we look to the annual number of applications in the Netherlands we must conclude that the availability of protection for new varieties under the PBR system indeed meets an existing need. In 1980 the number of applications was 620. After a period of steady growth during the eighties, the number of applications in the first years of this decade is more or less stabilized at a level of 1,400 per year. In 1992 applications fell into the following categories:

Agricultural crops	:	279
Ornamentals	:	1,031
Vegetables	:	54
Trees	:	37
Total	:	1,401

As you can see, the ornamentals formed by far the largest proportion of the total number of applications. In 1992 vegetables were responsible for less than 4% of the applications.

6. What is the reason for the modest position of vegetables compared to those of ornamentals and agricultural crops? I shall try to give an answer. Let me begin by saying that it is not the level of breeding activity in the vegetable sector that is responsible for the low number of PBR applications. In Europe, I say this in all modesty, the Netherlands is one of the most important, if not the most important, centers of breeding in this sector. Every year, hundreds of new varieties are more or less successfully put on the market. As I see it, the main reason for the fact that an application for PBR is made for only a small percentage of these varieties is that most of them have a limited commercial life of, let us say, from three to five years. For this reason it is in most cases not felt worthwhile to incur the costs of an application for PBR. It is in this context important to recognize that vegetables, for the major part sexually reproduced varieties, have a better natural protection than the mostly vegetatively propagated ornamentals. With the help of new techniques, for example in vitro propagation, it is, as you know, rather easy to produce many thousands of flowers on the basis of a small number of plants. Breeders of ornamentals are well aware of the ease with which third parties can reproduce the results of their efforts and are for that reason more inclined to protect their varieties than other breeders.

7. Another reason why breeders of vegetables are hesitant to seek protection for their "inventions" under the PBR system are the high costs involved in the testing of vegetables compared for instance to those of the testing of ornamentals. Due to their method of propagation, testing is relatively complicated and takes relatively more time. The testing costs are, at least in my country, reflected in the relevant fees charged to the breeders for the testing of their varieties.

8. The natural protection of sexually reproduced varieties is, however, not as strong as it used to be. New techniques have opened the way for the vegetative propagation of such varieties, including hybrids. Modern genetic engineering also threatens the natural protection of such varieties. For this reason, I expect that the breeders of vegetables will, in the future, increasingly seek the protection offered by PBR.

9. I would like to tell you now briefly how the PBR system in the Netherlands operates in practice. The authority responsible for dealing with applications for PBR is the Board for Plant Breeders' Rights. This is an impartial body independent from the government as well as the breeders. The Board consists of technical and legal experts with no links to the breeding industry. The Board at present has a small professional staff of five employees. The basis for the decision on an application for PBR is the technical examination of the variety concerned. The testing takes place at the testing center of the Board known as the CPRO or at a center in another country if the variety falls within the scope of a bilateral agreement (I will come back on that point later). Between 30 to 40% of varieties for which applications for protection were made in the Netherlands are tested abroad. Another possibility is that the variety has already been tested in another UPOV member State and that the results of that test are taken over by the Board. The number of people in the Netherlands involved in the testing itself or in the development of testing methods is about 40. Every application is published in our monthly Gazette in order that third parties can challenge the application or bring relevant information to the attention of the Board. Before a final decision is made, the applicant is informed of the outcome of the examination of his variety and given the opportunity to make objections. If the outcome is positive, he will, of course, not make any objections. In that case the Board takes a decision without hearing the applicant in person. If the test result is negative, the Board does not reach a final conclusion on the application before giving the applicant the opportunity to comment orally and/or in writing on the test

report. Appeals can be lodged by the breeder or by a third party against the decisions of the Board. Decisions on appeals by the appeal section of the Board are, with a few exceptions, final. I would like to show you now some pictures that can illustrate what plant variety protection in the Netherlands is all about.

10. For a few years now, protection under the PBR system has been available in the Netherlands for varieties of the whole plant kingdom. It is clear that we do not have the knowledge to cope with all the varieties which are eligible for PBR. This is one of the reasons why the Netherlands has bilateral agreements with other countries under which the Netherlands can ask other countries to test varieties of any species in relation to which the Netherlands does not have sufficient knowledge or experience. Another objective of this kind of international cooperation is to reach a certain degree of specialization between the countries concerned which in the long run can result in lower costs per test. As a rule, the more varieties of a crop are tested on one location, the lower will be the testing costs per individual variety.

11. Such cooperation is only feasible if the body responsible for the PBR system in a country has confidence in the way the testing will be done in the other UPOV member State. The breeders also must have confidence in the objectivity and neutrality of the testing in that other UPOV member country. In order to provide a legal guarantee, the Council of UPOV adopted in 1976 a model for an administrative agreement for bilateral cooperation in the field of technical examination. On the basis of this model UPOV member States have concluded bilateral agreements with each other. The Netherlands has entered into bilateral agreements with many other, mainly European, countries. In the north-western part of Europe, in countries such as France, Germany, the Netherlands and the United Kingdom, a system of centralized testing is functioning in a very satisfactory way. The countries concerned are currently involved in discussions with the aim of extending their cooperation to other crops as well.

12. As stated earlier, the Netherlands is one of the twelve member States of the European Economic Community ("EEC"). Since 1990 a proposal for an EEC Regulation on Plant Breeders' Rights has been under discussion in the competent bodies of this supranational organization. The Regulation is designed to set up a European system of plant variety rights, as a special form of industrial property right to encourage the development of new varieties of plants. It will be of interest for you to learn that the proposed system has the following features:

(i) It provides direct and uniform protection in the whole EEC based upon a single application by the breeder and a single decision on that application. To gain European coverage it is at the present time necessary to apply separately for PBR in all EEC member States that have a PBR system (two countries, namely Greece and Luxemburg, have at present no national legislation based on the UPOV Convention). You will understand that this is not only time-consuming, but also an expensive enterprise. I think that all breeders, not only European ones, wishing to protect their varieties in Europe will welcome the coming into force of an EEC scheme that will end this unfavourable situation.

(ii) In its substantive aspects the European PBR will be based on the UPOV Convention of 1991. It is the objective of the EEC to secure the status of Contracting Party (that is, to become a member of UPOV) under the UPOV Convention of 1991 once the EEC Regulation has been adopted by the member States.

(iii) It establishes a new body, the Community Plant Variety Office. A main requirement for an EEC system is the establishment of an office that has exclusive competence as far as decisions on applications for a European PBR are concerned. If the proposed system succeeds, as I expect, the national PBR authorities will of course gradually become less important. In this connection I should stress the point that the EEC system will not totally replace the national systems. If a breeder, for whatever reason, prefers one or more national rights to a European one, he will still be free to apply for the national title(s) of protection.

13. After hearing my enthusiasm for the new system you might be surprised to hear that the countries of the EEC have, notwithstanding many years of discussion, not yet reached a final agreement on all the parts of the draft Regulation. Problems of a rather formal nature remain outstanding, which I do not need to mention here. Of the other problems that form an impediment to reaching agreement, the main one, at least in my opinion, is the one related to the so-called "farmers' privilege," that is, the right for a farmer to use harvested material of a protected variety as propagating material on his own farm without the consent of the breeder of the variety. The 1991 Act of the UPOV Convention gives the member States, within certain limitations, a free hand to deal with this privilege in their national legislation. In the countries of the EEC, there is no common opinion on this issue. Some countries are in favor of a farmers' privilege limited to the main agricultural crops, others want this privilege extended even to ornamentals and vegetables.

14. I am a strong supporter of a limited farmers' privilege for conditions in the EEC. I am afraid that if the farmer would get a more or less unlimited privilege to replant his previous year's crop, this would have a negative effect on the breeding industry. In the United States of America, the number of private wheat breeders has dropped dramatically in recent years under the influence of the rather strong farmers' privilege which exists in that country. Given the necessity, particularly under EEC conditions, for a steady stream of new varieties and also of material of high quality of existing varieties, it is in the interest of no one, least of all the farmers, that the position of the professional breeder would be substantially weakened by giving the farmers a far-reaching privilege as described above.

15. In principle, there is no good reason to limit international cooperation to countries within the same part of the world. The Netherlands, for instance, collaborates on a case-by-case basis with countries which, for us anyway, are far away like Australia and Japan. In practice this kind of cooperation has its natural limits. We only have to think of the problems connected to the sending of plant material over long distances. Cooperation limited to the taking over of the results of tests already performed in other countries presents lesser obstacles. A precondition for technical cooperation is that both countries perform their tests on the same basis. In order to harmonize the testing methods and to guide the experts in their work, the UPOV Test Guidelines are of great importance. They contain practical indications about trial layout and a descriptive list of characteristics. At this moment, guidelines for almost 150 species are ready or in preparation.

16. I do hope that the People's Republic of China and other developing countries in the Asian and Pacific Region will in the near future join the UPOV community. My country, and I am sure many other countries, would be willing to cooperate with you and give you advice, as far as needed, to start a system of protection of plant varieties on the basis of the UPOV Convention.

Thank you for your friendly attention.

PLANT VARIETY PROTECTION IN CANADA-
THE EXPERIENCE OF A NEW MEMBER STATE OF UPOV

I. BACKGROUND

1. The first efforts to establish plant breeders' rights in Canada were made in 1923 by the Canadian Horticultural Council. However, it was not until 1990, sixty-seven years later, that the Plant Breeders' Rights Act became law in Canada. The agriculture and horticulture sectors envisioned several benefits for their industries with the introduction of plant breeders' rights (PBR) in Canada. It was anticipated that the legislation would:

- encourage investment in plant breeding in both the public and private sectors;
- increase the availability of improved varieties for Canadian producers;
- increase access to foreign varieties;
- provide a legal basis for breeders to collect royalties on their varieties;
- facilitate the protection of varieties in member States of the Union.

2. With the introduction of PBR in August 1990, Canada was in a position to join UPOV. We became the 20th member of UPOV on March 4, 1991, by ratifying the 1978 Act of the Convention.

3. One of the requirements of the legislation was for the Minister of Agriculture to appoint the Plant Breeders' Rights Advisory Committee to assist the Commissioner in the implementation of the Act. The committee includes representatives from organizations of breeders of plant varieties, seed retailers, seed growers, farmers, horticulturists and any other interested persons considered appropriate by the Minister. The Advisory Committee supported the implementation of a "beneficiary pays" system in which fees are collected for services provided by the PBR Office (PBRO). It was decided that a breeder testing system, similar to Australia, would be best suited to Canada. The Committee also supported the suggestion that the addition of new species eligible for protection should be introduced on a priority basis.

II. HISTORY OF PLANT BREEDERS' RIGHTS IN CANADA

<u>Development up to present</u>

1989 - Legislation was introduced in the House of Commons on May 8, 1989.

1990 - PBR came into force on August 1, 1990.

1991 - November 6, 1991. Regulations were introduced for the first six categories: canola, chrysanthemum, potato, rose, soybean and wheat.

1993 - March 10, 1993. Regulations were introduced for additional 17 categories: African violet, alfalfa, apple, barley, bean, dianthus, cherry, corn, flax, grapevine, oats, pear, pea, poinsettia, potentilla, strawberry and yew.

Future Initiatives

1994 - It is expected that regulations will be implemented for additional 16 categories: begonia, blueberry, clematis, creeping red fescue, impatiens, Kentucky bluegrass, lentil, maple, mustard, peach, pelargonium, plum, raspberry, spirea, timothy and viburnum.

1995-
1996 - An additional list of 15-20 categories will be introduced by regulation. This list is yet to be developed. Following this we will discuss with the PBR Advisory Committee the possibility of opening up the legislation to cover all species.

Eventually we will amend our current legislation in order to ratify the 1991 UPOV Convention. Canada signed the 1991 Convention in March 1992. However, it will be several years before we start the amendment process in order to provide time for industries to become familiar with the current system.

III. STATISTICS

(i) Fees: The Plant Breeders' Rights Office charges fees for its services. A list of basic fees is provided below. The Office is to be fully cost-recovered by the year 2000.

Plant Breeders' Rights Fees

Filing an application	$ 250
Protective direction	$ 50
Examination of an application	$ 750
Issuance of PBR certificate	$ 500
Annual fee	$ 300

(ii) Report on applications received: The tables on pages 76 and 77 detail the number of applications received and rights granted, and include information on crop kind and country of origin. Figures were calculated from applications received during the period from November 6, 1991, to August 10, 1993.

(iii) Summary: The diagrams (charts on page 78) illustrate the proportion of applications received from different categories. Comparisons are made between applications received from Canadian and foreign sources.

4. One of the factors contributing to the number of applications received is determined by sales prior to application. During the first year that protection for a category is introduced by regulation, the time frames for prior sales are broader than normally permitted. Categories are referred to as 'recently prescribed' during the first year. Prior sales for recently prescribed categories can take place for approximately three years (from August 1, 1990, onwards) in Canada, and for approximately seven years (from August 1, 1986) to nine years (August 1, 1984) outside Canada depending on the species. This has resulted in a large influx of applications during the first year that a category is introduced by regulation. For example, during the first year potatoes were introduced, 78 applications for potato varieties were received.

5. Following the initial one year period, the normal time frames for prior sales are applied. Categories are then referred to as 'prescribed'. Sales prior to application for prescribed categories are not permitted at all inside Canada, while outside Canada prior sales are permitted for up to four years (or six years for slower growing species such as trees).

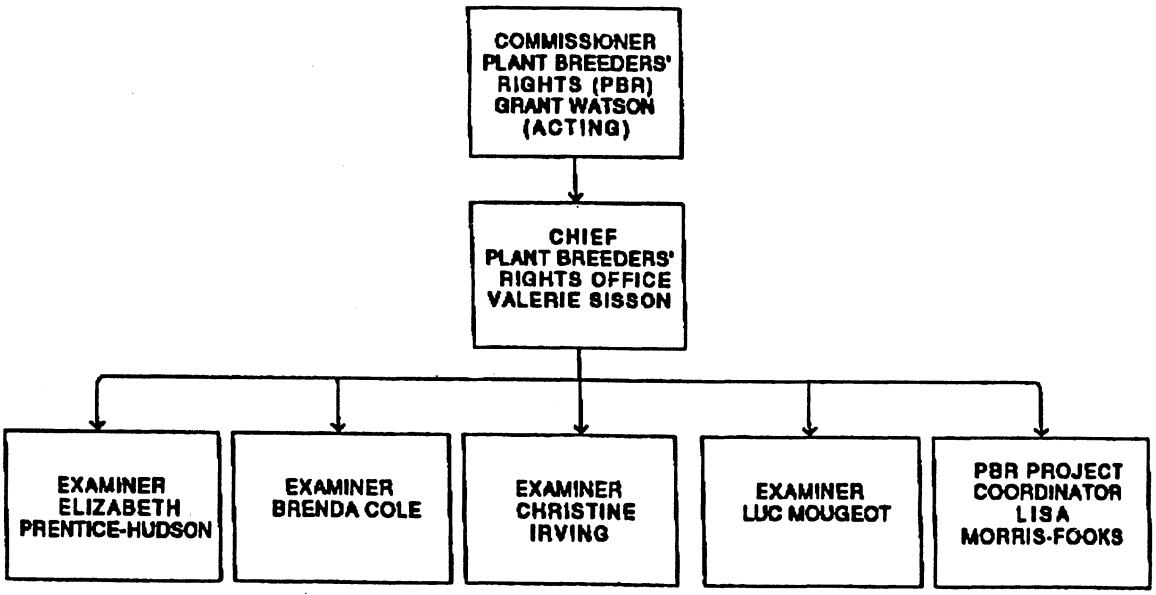
IV. ADMINISTRATION OF THE PLANT BREEDERS' RIGHTS OFFICE

6. The Canadian Plant Breeders' Rights Office is part of the Plant Products Division, Plant Industry Directorate, Food Production and Inspection Branch, Agriculture Canada.

7. The Office is made up of a team of seven people:

- Commissioner of Plant Breeders' Rights (Grant Watson-Acting)
- Chief of Plant Breeders' Rights (Valérie Sisson)
- Four Examiners (Elizabeth Prentice-Hudson, Brenda Cole, Christine Irving, Luc Mougeot)
- Project Coordinator (Lisa Morris-Fooks)

The Plant Breeders' Rights Office



Total PBR Applications by Crop

Total applcations accepted for filing: 219

Common name:	Canola	Total applications:	13
Total by country			
Canada		5	
Denmark		1	
Sweden		7	
Common name:	Chrisanthemum	Total applications:	73
Total by country			
USA		71	
United Kingdom		2	
Common name:	Flax	Total application:	1
Total by country			
Canada		1	
Common name:	Pea	Total applications:	5
Total by country			
Sweden		4	
United Kingdom		1	
Common name:	Potato	Total applications:	88
Total by country			
Canada		2	
Germany		2	
Ireland		4	
Sweden		4	
Netherlands		59	
USA		8	
United Kingdom		9	
Common name:	Rose	Total applications:	25
Total by country			
Canada		2	
Germany		1	
Netherlands		1	
USA		21	
Common name:	Soybean	Total applications:	7
Total by country			
Canada		7	
Common name:	Strawberry	Total application:	1
Total by country			
Canada		1	
Common name:	Wheat	Total applications:	6
Total by country			
Canada		3	
Germany		1	
USA		2	

Total PBR Applications Granted Rights by Crop

Total rights granted: 45

Common name:	Canola	Total grants:	2
Total by country			
Denmark		1	
Sweden		1	
Common name:	Chrisanthemum	Total grants:	43
Total by country			
USA		43	

8. The major roles and duties of the PBRO involve:

(i) granting of rights;

(ii) examination of applications for PBR;

(iii) development of objective description forms based on the UPOV Test Guidelines;

(iv) quarterly publication of the Plant Varieties Journal detailing information on PBR;

(v) site examination of breeder trials;

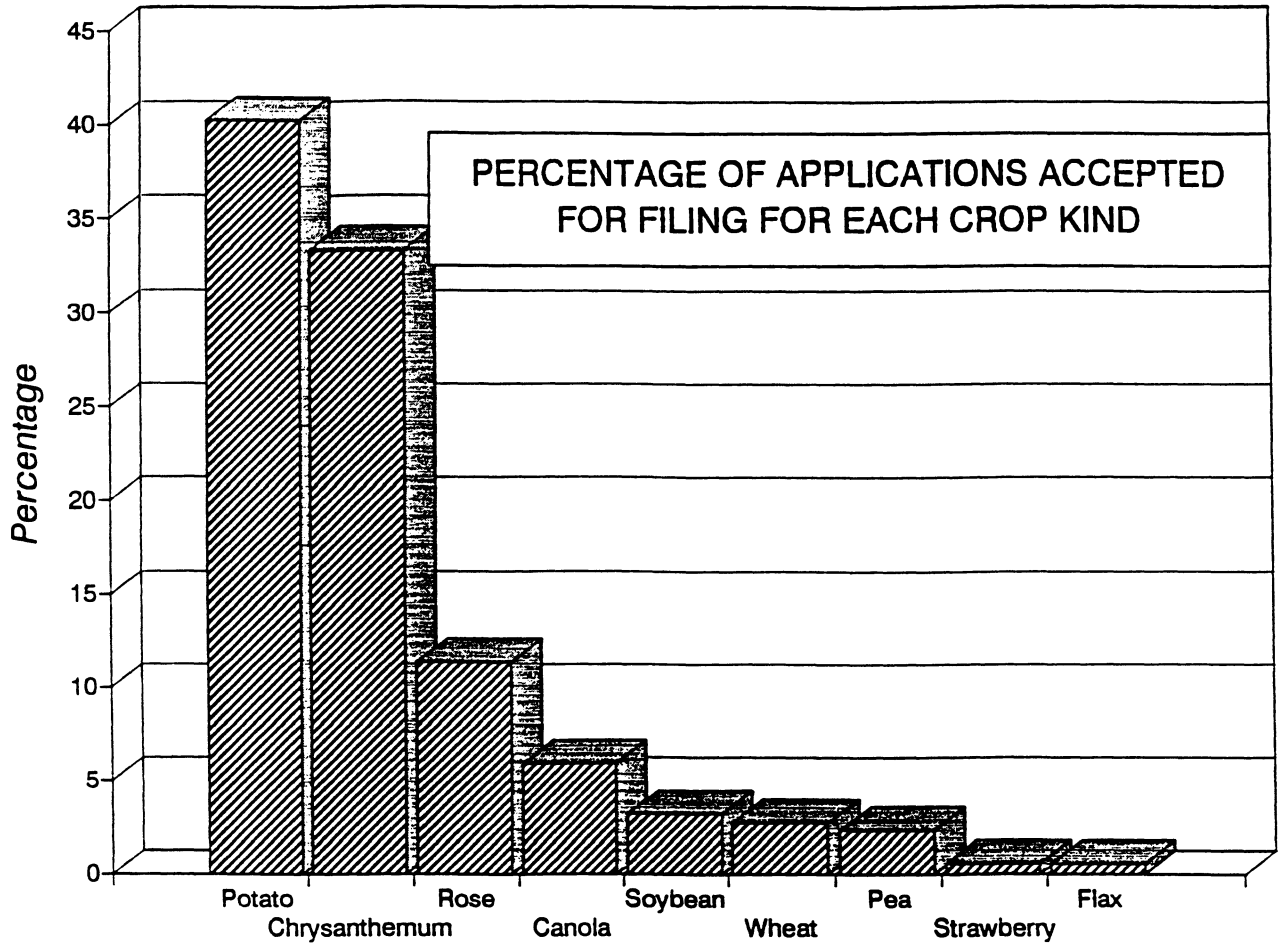
(vi) drafting regulations for the introduction of new categories and consultation with the PBR Advisory Committee on regulatory change;

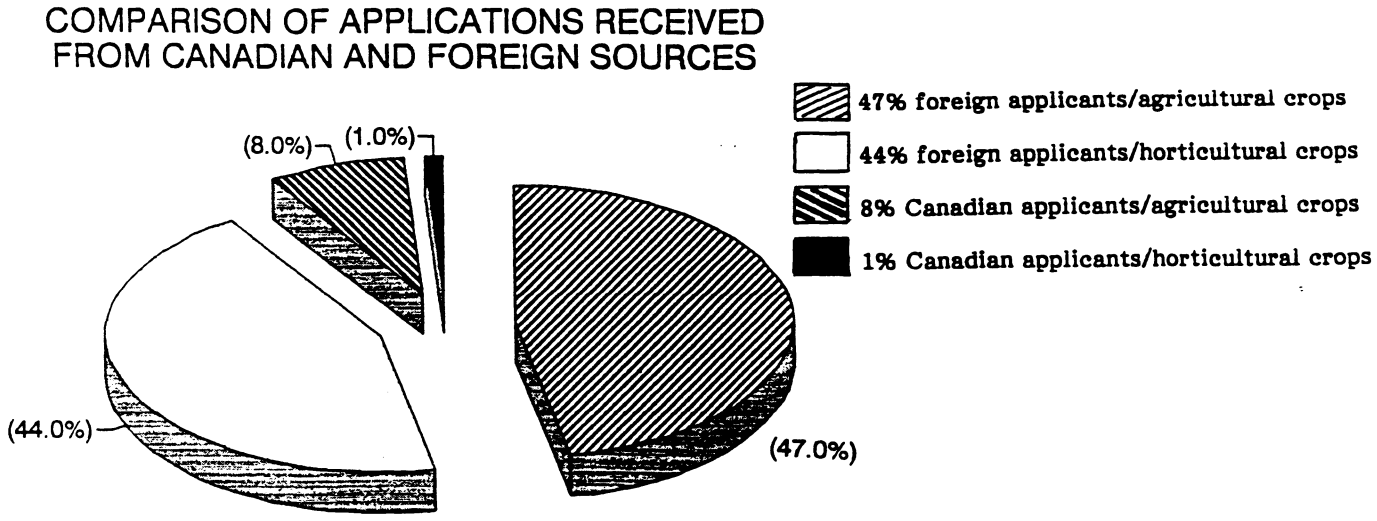
(vii) development of internal policies.

9. The PBRO team is networked together by a computer system composed of seven Macintosh computers. All machines have file sharing capabilities. The PBR database system is a multiple-user system which includes a very broad database, strong reporting capabilities and a dynamic "Bring Forward" feature. The "Bring Forward" component is an office automation feature which notifies users of important dates pertaining to specific applications.

V. DISTINCTNESS, UNIFORMITY AND STABILITY (DUS) TESTING AND INTERNATIONAL COOPERATION

10. Canada adopted a breeder testing system similar to Australia. The major consideration for this choice was for the office to operate on a beneficiary-pays basis. With a breeder testing system the State is not responsible for performing DUS trials. Instead the breeder, or the contracting agency, must perform the DUS trials and submit all results to the Plant Breeders' Rights Office. The system was supported by the Canadian Plant Breeders' Rights Advisory Committee.





AGRICULTURAL CROPS canola flax pea potato soybean wheat

HORTICULTURAL CROPS chrysanthemum rose strawberry

11. The major areas of the breeder testing system are as follows:

(i) PBRO does not perform State run trials for DUS.

(ii) Breeders must submit seed samples at the time of application.

(iii) Breeders perform their own PBR tests and trials for determining DUS.

(iv) PBRO recommends to breeders to conduct DUS trials in accordance with UPOV test methods. The PBRO reprints these methods in the objective description forms.

(v) PBRO requires breeders to conduct tests for the time period specified in the UPOV Test Guidelines.

(vi) PBRO develops objective description forms for all categories (based on the UPOV Test Guidelines). Breeders complete the form using their own DUS trials. The characteristics measured are used as a basis for the description of the variety.

(vii) PBRO examiners visit breeder trials for on-site examination.

(viii) PBRO publishes the variety description and other details of the application in the Plant Varieties Journal. The description is supplied by the breeder and is based on the characteristics measured/observed in the breeder trials. The descriptions distinguish the candidate variety from the most similar variety/ies. Interested persons may object to the particulars of a published application for up to six months from the date of publication. If there are no objections, and PBRO determines that the variety is distinct, uniform and stable, then the applicant may be issued a grant of rights after the six month objection period is over.

(ix) Breeders must pay a $300 annual fee to maintain their rights.

(x) The holder of a plant breeder's right is responsible for enforcing the right.

12. The flow chart overleaf presents an overview of the application process. The minimum time from when an application is received to when a right is granted is nine months, provided that the breeder trials are completed.

13. At the present time, Canada does not participate in agreements for international co-operation for DUS testing. There have been requests to use results from private foreign tests and trials, but to date we have not been requested to purchase results from Plant Breeders' Rights Offices in UPOV member countries. However in the future, we anticipate that such arrangements will be made.

VI. INDUSTRY RESPONSE TO PLANT BREEDERS' RIGHTS

14. Canada has been receiving applications for plant breeders' rights since November 6, 1991. It is difficult to establish whether any trends have yet developed. Continuous efforts are being made by media, industry members and the Department of Agriculture to educate and inform the various industry sectors of the benefits of Plant Breeders' Rights.

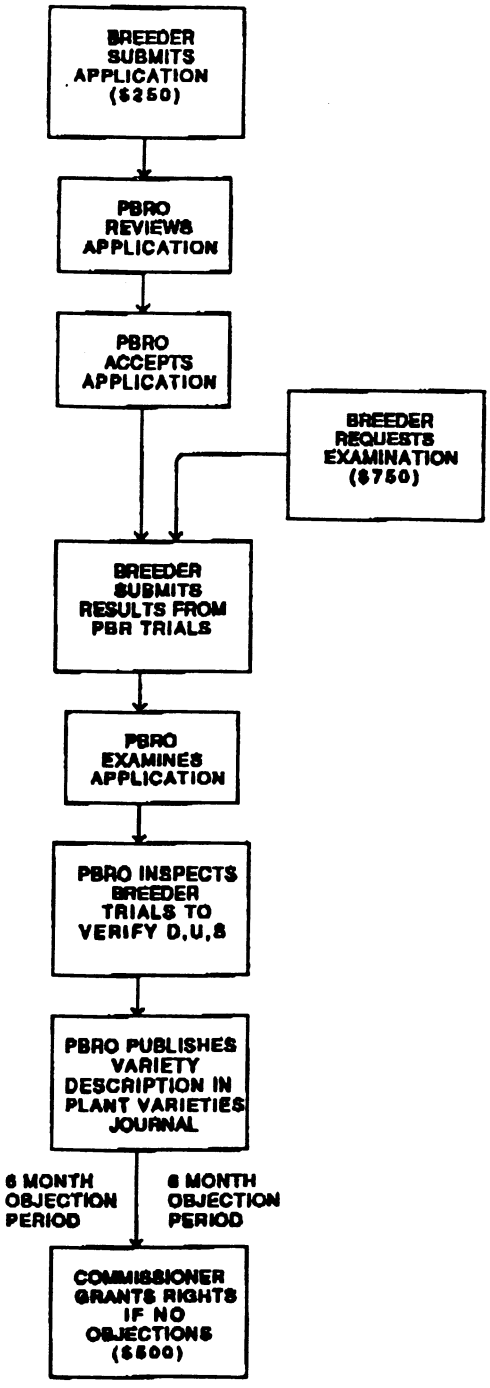
15. The agriculture industry recognizes PBR's growing importance in the seed industry. The two key points that industry considers as the cornerstones of PBR are:

(i) to prevent unauthorized sales of seed of their protected varieties;

(ii) to secure royalties for their varieties.

16. The horticulture industry has benefitted from PBR through the increased introduction of foreign varieties.

Overview of the Application Process



ANNEX

Schedule by Crop Kind for Introducing PBR Regulations in Canada

Crops Prescribed by Regulation:
(as of November 6, 1991)

Canola/Rape
Chrysanthemum
Potatoes
Roses
Soybeans
Wheat

Crops Recently Prescribed by Regulation:
(as of March 10, 1993)

African Violet
Alfalfa
Apples
Barley
Beans
Cherries
Corn
Dianthus
Flax
Grapevines
Oats
Pears
Peas
Poinsettias
Pottentillas
Strawberries
Yews

Crops to be Covered by Tertiary List
(estimated by late 1994)

Begonia
Blueberry
Clematis
Creeping Red Fescue
Impatiens
Kentucky Bluegrass
Lentils
Maple
Mustard
Peach
Pelargonium
Plum
Raspberry
Spirea
Timothy
Vibrunum

THE TESTING OF FLOWER VARIETIES IN JAPAN

Botanical Genera and Species Eligible for Protection

1. In Japan, botanical genera and species for which protection may be granted are listed in the regulations under the Seeds and Seedlings Law. For the time being, 430 taxa (233 genera, 188 species, 9 subspecies) which are cultivated for agriculture are protected.

Total protected taxa	Genera (233)	Species (188)	Subspecies (9)	Total taxa (430)
of which ornamentals	197	79	1	277
of which - herbaceous plants	138	48	1	187
- trees	59	31	0	90

Botanical Taxa for Which DUS Testing Can be Carried Out

2. In order to secure protection under the Japanese scheme of plant variety protection, a variety must be tested. Such a test is carried out following guidelines established for each botanical taxon by the Ministry of Agriculture, Forestry and Fisheries (Seeds and Seedlings Division) which determine the characteristics to be observed and their scales of measurement. Currently, guidelines have been established for 277 botanical taxa (of which 102 are for herbaceous ornamental plants and 24 are for ornamental trees). For the other botanical taxa, test guidelines are established once the initial application for protection for a variety belonging to that taxon is filed with the Ministry of Agriculture, Forestry and Fisheries.

3. In order to establish a new test guideline, the Ministry of Agriculture, Forestry and Fisheries organizes an expert study group consisting of real experts on the botanical taxon concerned, including university professors, researchers of agricultural or horticultural research institutes and seed companies and even individuals who breed. DUS testing is carried out exclusively on the basis of national test guidelines established in this way. However, if available, UPOV Test Guidelines are used as a basis for the drafting of such national test guidelines.

4. The total number of applications for protection, as from the entry into force of the Seeds and Seedlings Law in 1978 to March 31, 1993, is 6,240, of which 3,414 (55%) have been made for herbaceous ornamental plants and 849 (14%) for ornamental trees (this expression includes woody shrubs). Thus nearly 70% of the total amount of applications have been made for ornamental plants.

5. The total number of applications per annum has been increasing steadily from 347 applications in the 1983 fiscal year (April 1, 1983, to March 31, 1984) to 780 in the 1992 fiscal year: thus the number of applications per annum has doubled in ten years. For ornamental plants, the number of applications increased from 237 in the 1983 fiscal year to 605 in the 1992 fiscal year (255%). During the same period the number of applications for herbaceous

ornamental plants increased from 167 to 520 (311%). The species for which most applications were filed were carnation (572 applications), cymbidium (433), chrysanthemum (431) and lily (241). Among ornamental trees, the number of applications for rose varieties amounts to 547 and accounts for 64% of the total number of applications for ornamental trees.

6. Out of the 187 herbaceous ornamental taxa and 90 ornamental tree taxa which are protectable, applications have been filed so far for 107 herbaceous ornamental taxa and 32 ornamental tree taxa.

Number of Protection Titles

7. The total number of protected varieties was 3,571 on March 31, 1993, of which 1,624 were herbaceous ornamental varieties (45%) and 556 were ornamental tree varieties (16%). Thus nearly 70% of the total of protection titles were granted to ornamental varieties.

8. With the increase of the number of applications the annual number of granted protection titles has increased from 196 in the 1983 fiscal year (April 1, 1983, to March 31, 1984) to 468 in the 1992 fiscal year (239%). The number of protection titles granted to herbaceous ornamental varieties also increased, during the same period, from 90 to 274 (304%) and the number of protection titles granted to the whole sector of ornamental varieties moved from 133 to 358 (269%).

9. Among the protection titles so far granted for herbaceous ornamental varieties (1,624 titles), 295 were granted for carnation, 202 for cymbidium, 192 for chrysanthemum and 111 for lily. Among ornamental tree varieties 344 protection titles were granted for roses, which represent 62% of all protection titles granted for ornamental trees.

10. From among 187 herbaceous ornamental taxa and 90 ornamental tree taxa which are eligible for protection (see paragraph 1), protection titles have been granted so far for varieties belonging to 80 herbaceous ornamental taxa and 27 ornamental tree taxa.

Application for Protection of Varieties Bred Overseas

11. The number of applications for protection has been increasing also with respect to varieties which have been bred in foreign countries. As of March 31, 1993, the number of such applications was 1,368, thus accounting for 22% of the total applications. 1,126 applications, which represent 82% of the total foreign applications, have been sent from four countries, in the order of the number of their applications, the Netherlands, Germany, France and the United States of America.

Organization of DUS Testing

12. DUS testing is the responsibility of the Ministry of Agriculture, Forestry and Fisheries. Currently 10 examiners are working under the chief examiner of the Seeds and Seedlings Division of that Ministry. In practice, DUS testing may take the form of a documentary examination or a field trial or an *in situ* field inspection. The examiner in charge of a candidate variety decides on the appropriate form of DUS testing.

13. Documentary examination: If a variety has been bred by a governmental breeding station, has undergone large-scale field trials for at least two growing seasons and has been accepted, after examination by experts from governmental experiment stations, for release as a recommended variety, the examiner may take a decision on the protectability of the variety on the basis of data provided by the breeding station which has bred that variety.

14. Field trial: Normally a candidate variety is cultivated in the field side by side with varieties which are deemed to be most similar to the candidate variety so that the characteristics of the candidate variety can be compared under the same conditions with the nearest, or most similar, known varieties. There currently exist 14 governmental experiment stations which are located along the Japanese archipelago from Hokkaido to Okinawa, thus covering the area between 45 and 25 degrees north including the frigid and subtropical climate zones. Field trials are carried out also by prefectural agricultural experiment stations in 47 prefectures and by universities.

15. In situ field inspection: If the breeder/applicant is considered to be capable of planting and maintaining a test plot on his premises in accordance with the instructions laid down in relevant test guidelines, the examiner travels to that testing plot, usually together with a botanical specialist (variety investigator) to observe the testing plot and gather necessary technical data. The variety investigator is usually selected from among university professors, researchers of research institutes and breeders who are familiar with the species concerned.

Practical Procedures of DUS Testing

16. In Japan, a variety for which an application for protection has been filed is examined as follows:

(1) A copy of the application form is sent to an examiner of the Seeds and Seedlings Division together with a variety description sheet.

(2) The examiner checks the information contained in the application form on technical items such as breeding history, parental varieties, method of crossing, selection, fixing and growing as well as the suitability of the variety denomination. The examiner may request the applicant to provide additional information if he deems it to be necessary.

(3) The examiner decides whether, on the basis of the information provided by the breeder, as mentioned in subparagraph (2), the candidate variety should undergo a field trial or an in situ field inspection.

(4) The examiner informs the applicant of the form of examination. In the case of a field trial, the information should contain the names of the research institute where the trial will be carried out, the person responsible for the carrying out of the trial, the amount and the condition of plant materials of the variety necessary for the trial and the time of their sending to the trial place. In the case of in situ field inspection, the examiner gives the applicant instructions necessary for the planting of the trial on the applicant's premises, such as: amount of plant material to be grown (for example 30 plants in the case of carnation), growing conditions, names of varieties which should be planted alongside the candidate variety. The applicant must communicate to the examiner the most suitable period for the field inspection.

(5) Field trial: Plant material of a candidate variety provided by the applicant are grown in the trial field of a research institute designated by the examiner, following the growing conditions prescribed for the species to which the variety belongs. For flower varieties, 183 varieties underwent field trials in 11 governmental research institutes and 55 in 14 prefectural research institutes in 1992. Technical data are recorded in the trial fields in accordance with the guidelines and, after having been summarized, are sent to the examiner together with the comments on the protectability of the candidate variety of the researcher of the testing institute who has assembled the technical data. The examiner then examines the technical data, finalizes the description of the candidate variety in comparison with reference varieties and other existing varieties and decides finally on its protectability.

(6) In situ field inspection: The examiner travels to the test location planted and maintained by the applicant to collect technical data at the most suitable period (e.g. flowering period in the case of carnation). At the time of field inspection the examiner checks the information given in the application form and the variety description sheet, such as the names of breeder and applicant, breeding history, parental varieties, methods of crossing, selection, fixation and cultivation. He observes the candidate variety grown in the trial location and checks visually for the presence of off-types in flower color, flower type, plant type. He also checks the stability. The examiner then takes samples from the plant material of the candidate variety and establishes technical data either by visual observation or by measurement. Color characteristics, which are especially important in the case of flower varieties, are measured by means of color charts (Japan Horticultural Standard Color Charts), which were established in Japan for the testing of plant varieties and are compatible with the RHS (Royal Horticultural Society) Color Charts.

(7) Decision on the criteria for variety protection: The examiner finally decides on the distinctness, homogeneity and stability of the variety and the suitability of the variety denomination on the basis of data and information made available to him. For the decision on the suitability of the variety denomination reference is also made to trademarks registered with respect to seeds and seedlings and related goods. The Trademark Division of the Japanese Patent Office collaborates in this respect with the Seeds and Seedlings Division of the Ministry of Agriculture, Forestry and Fisheries.

(8) Preliminary publication: If the examiner has concluded that the candidate variety fullfils all criteria for protection, relevant information concerning the candidate variety is published in the official gazette together with its final description. This information is sent at the same time to prefectures, extension service stations, universities, research institutes and other relevant agencies. Any person who has an objection to the protection of the variety may send his opinion together with evidence to the Ministry of Agriculture, Forestry and Fisheries.

(9) Registration of variety: If no objection to the protection of the variety has been received within 60 days counting from the date of the preliminary publication, the variety is officially registered with the Ministry of Agriculture, Forestry and Fisheries as a protected variety. The final registration is also published in the official gazette.

(10) Registration fee, issuance of a certificate: A certificate of protection of the variety is sent to the applicant on payment of the registration fee.

Plant Variety Protection Statistics as of March 31, 1993

	Total number of applications	Varieties under DUS testing	Withdrawn or rejected applications	Varieties under preliminary publication	Total number of registered varieties
Agricultural crops	393	85	9	8	291
Industrial crops	75	11	1	0	63
Mulberry	12	3	0	0	9
Vegetables	642	113	62	9	458
Fruit Trees	602	122	63	13	404
Forage Crops	80	22	1	1	56
Herbaceous ornamental plants	3414	1511	222	57	1624
Ornamental Trees	849	228	40	25	556
Forest Trees	11	2	0	0	9
Seaweeds	3	0	0	0	3
Mushrooms	159	51	3	7	98
TOTAL	6240	2148	401	120	3571

PLANT VARIETY PROTECTION IN THE FLOWER BUSINESS

I. HISTORY OF PLANT VARIETY PROTECTION (PVP) IN JAPAN AND PROBLEMS CREATED WITHIN THE JAPANESE FLORICULTURE INDUSTRY

1. In 1947 the Seeds and Seedlings Law was proclaimed in Japan. In July 1978 this Law was revised. In 1979, Japan, many years after many important Western Countries, signed the UPOV Convention.

2. Previously, open-pollinated plants which were reproduced through seed, after years of hybridizing work by breeders (hybridizers), were freely propagated and sold as pot plants or in the form of cut flowers on the open market. In a real sense this meant very little remuneration for the originating breeder and it was difficult or almost impossible to really encourage good hybridizers (breeders) of species reproduced by seed. The only exceptions were breeders of outstanding varieties of some vegetatively propagated species such as chrysanthemums, roses, and carnations which could be sold on the cutflower market at a premium price.

3. The Helianthus annuus (sunflower) variety 'Taiyô' bred in 1971 was handled by almost all seed dealers in Japan as a valuable cut flower item and soon became the leading cut flower sunflower on the market. 'Taiyô' was bred by a cut flower grower as an all-season variety which could be cut and shipped to the market throughout the year. Sakata discovered this variety at the cut flower grower's premises and paid a lump sum for the sole sales rights in Japan but was able to maintain some exclusivity in the variety for only a short period of two to three years since 'Taiyô' was an open-pollinated variety.

4. For this reason, all seed companies began breeding F_1 hybrids of seed propagated species. As early as 1930, Sakata succeeded in introducing the all-double petunia as an F_1 hybrid and in 1940 bred the first F_1 hybrid cabbage sold in Japan which made history in F_1 hybrid breeding. In the 1950s, several F_1 hybrid vegetables were bred and appeared on the market, while amongst the flowers only snapdragons and petunias were available.

5. Sakata received a large number of requests from overseas breeders for Sakata to market their protected vegetatively propagated varieties in Japan. However, in the absense of PVP (Plant Variety Protection) in Japan at the time, all of these requests were declined since once growers with the proper facilities and knowledge had purchased such varieties, they were able to increase and sell such protected varieties, and there was no law or possible way of collecting royalties on sales of protected varieties.

6. Later in 1978, a new Seeds and Seedlings Law was passed. However, even under the provisions of the Law, if a grower purchased seeds or seedlings for propagation which were sold in the form of propagating material and not in other forms such as cut flowers or potted plants, the grower was still free to sell the resulting material as cut flowers or potted plants. Therefore, the breeders' rights were not effectively protected. In order to protect the breeder, an agreement had to be concluded individually by each grower, that may read: "This variety is protected by PVP and unlawful propagation is prohibited." This condition was an important and vital part of the agreement between the grower and the breeder forbidding unlawful propagation of protected varieties. While this procedure involved a considerable amount of paperwork, this was the only way the breeder's right could be protected. After very strong pressure by MAFF (Ministry of Agriculture, Forestry and Fisheries)

the new Law finally became well known and was accepted by most growers. It is believed that about 90% or more of the growers now abide by this Law.

7. However, for open-pollinated varieties reproduced by seed, it is still not possible to obtain such an agreement from growers and this creates considerable problems. It is still very difficult to breed an F_1 hybrid of, for example, Mathiola incana (stock) and growers are able to save their own seed, even of PVP protected varieties, for cut flower production. It is not possible under the present Law to submit claims to individual growers who harvest their own seed for cut flower propagation purposes as a result of the growers' privilege of the Law.

II. FLOWER INDUSTRY AND PVP CULTIVARS

Flower Seeds

8. Flower seeds are either of F_1 hybrids or open-pollinated varieties. About 100 F_1 hybrid species are grown of which 40 are considered most important, including for example Eustoma (Lisianthus), Antirrhinum (snapdragon), Helianthus (sunflower), Lilium Formo-Longo as cut flowers and Primula, Cyclamen, Petunia, Begonia, Impatiens, Dianthus, Pansy and Marigold as pot and bedding plants.

9. About 45 open-pollinated species are grown of which about 31 are considered most important, including for example Lathyrus (sweet pea), Limonium (statice), Eustoma (Lisianthus), Matthiola (stock) as cut flowers and Calendula, Primula, Cyclamen, Salvia, Catharanthus (Vinca), Callistephus (China aster) as pot and bedding plants.

10. As in the case of vegetables, flower seed businesses are devoted to developing F_1 hybrids; it is now possible to see F_1 hybrids of Campanula medium, Delphinium, Ranunculus and Cineraria. Most of these hybrids, including new and old hybrids, are not PVP registered as F_1 hybrids are self-protected.

11. Amongst open-pollinated items, Callistephus chinensis (Aster chinensis), Carthamus, Celosia, Cosmos, Cyclamen, Helianthus, sweet pea, Matthiola incana (stock), and nearly all newly bred items are covered by PVP, particularly the more important species such as Cosmos, Callistephus, Celosia, and Matthiola incana (stock) which are large and important cut flower items. It is believed that PVP protection will be highly beneficial to breeders of these species (see Annex II).

12. As mentioned in paragraph 7, Matthiola incana (stock) growers can propagate the seed even of PVP protected cultivars. However, it is prohibited for seed companies to propagate and market seed of open-pollinated PVP protected cultivars. In this case, PVP protection is very effective. China aster, in the seed production stage, is very susceptible to Fusarium infection and here again PVP protection is essential.

Flowering Bulbs

13. Formerly, nearly all imported flowering bulbs had to be grown in post-entry quarantine in rice paddies for one year and could only be sold in the second year. More recently, certain species, but only if imported from

the Netherlands, were freed from post-entry quarantine, e.g. certain varieties of tulip, lily, crocus and hyacinth.

14. In Japan the major growing districts for flowering bulbs are in areas with heavy snowfall during the winter months, such as the Sea of Japan area, Hokkaido and Northeastern Japan. It is firmly believed that PVP will play an important role in protecting important cultivars as bulbs are freed from post-entry quarantine and increased in Japan. If varieties are bred in Japan, suited for Japanese climatic conditions, it is even more important to obtain PVP protection.

15. However, since the evolution of flower items in Japan changes so rapidly, there are cases where applying for PVP has little meaning. For example, during recent years, biotechnology has come to play a very important part, particularly in lily bulbs, making inter-specific hybrids possible. For instance, it is now possible to hybridize Lilium longiflorum with Asiatic hybrids, and a number of these hybrids are already available. Due to the very rapid pace of new varieties becoming available, growers are often confused.

Clones, Cut Flowers and PVP

16. As previously mentioned, the history of PVP in Japan is relatively new, being only about 20 years. For this reason, clonal breeding is far behind other countries. However, PVP has been applied for chrysanthemums, hybrid limonium, roses (cut flower and garden roses), Hydrangea and Clematis bred in Japan under agreement with American and European firms.

17. In the case of carnation, which is the second most important flower species after chrysanthemum, PVP is used as follows: the total area cultivated is 611 hectares (2 hectares outdoor cultivation, 609 hectares protected cultivation). Quantities shipped to cut flower markets are 667 million stems. These figures include quantities auctioned at major wholesale cut flower markets and also include quantities re-shipped to smaller markets. The quantities actually sold at the major wholesale cut flower markets are 494 million stems. The ratio of PVP and non-PVP carnation varieties is estimated to be:

	PVP	NON-PVP
Spray-type varieties	76.6%	23.4%
Other standard varieties	38.5%	61.5%
TOTAL:	55.6%	44.4%

As per the above table, standard carnations have a very long history in Japan, and very old unprotected varieties bred in Japan are still produced and sold. Such varieties include 'Coral' and 'Kibô' while old imported varieties, such as 'Scania', 'Nora', 'Lena', 'Romeo', etc., still exist.

18. Due to the very different climatic conditions in Japan, cultivation of new varieties of standard carnations in Japan is very difficult and poses a number of problems and requires highly-skilled growing techniques. Old established varieties are adapted to the Japanese climate, and growers are able to successfully grow them without much problem, while with the new cultivars, for proper cultivation it is first necessary to know the particular characteristics of each variety. It is necessary to test new varieties in order to know how to properly grow them. It is estimated that only about 38.5% of sales of standard carnations are of PVP protected varieties.

19. Spray types are relatively new in Japan. Imported varieties comprise the mainstay. Such old varieties as 'Angel' are still produced in Japan, with 'Barbara Family' being the most important item. PVP registration is highly valued.

20. Twenty to thirty years ago, the cutting production industry in Japan was very poor and primitive, and unable to supply disease-free cuttings on time to satisfy growers. However, the market demanded better varieties and gradually PVP varieties outnumbered non-PVP varieties. At the same time, the cutting production system was completely changed making it possible to supply disease-free cuttings at the time growers needed them, and the self-propagation of cuttings by growers decreased greatly. In 1992, when Japan's so-called 'Bubble Ecomony' collapsed, the demand for all consumer goods slowed down considerably and, in particular, the demand for high-priced luxury items decreased immensely. The demand for cut flowers, however, which were in the middle-price class, increased enormously.

21. In the cut flower industry, high productivity is most important, followed by vase life (keeping quality), and wilt resistance is the most important characteristic required of all cultivars. Consumer tastes change very rapidly, so that this factor and the rate of variety development mean that the life-span of any variety has become very short. For this reason, even if PVP is applied for, in many cases, it is necessary to cancel the application or surrender the rights due to the very short life-span of any given cultivar.

22. The demand for and usage of ordinary chrysanthemums decreases yearly, while the demand for Japanese-type spray chrysanthemums increases tremendously. Due to their short vase life and competition from double Eustoma, the demand for roses has not increased. Limonium production has changed from seed varieties to clones.

23. Gypsophila, Gerbera, Alstroemeria, orchids, pot plants such as Kalanchoë, Poinsettia, Pelargonium and New Guinea impatiens are mostly of European and American PVP protected varieties, while Hydrangea, Gentiana and Clematis are mostly of Japanese PVP protected varieties.

24. Furthermore, in recent years, selections made from certain seed strains have been propagated by stem apex culture (mericlone). The following varieties propagated by mericlone are PVP protected and are widely distributed on the market:

- Snapdragon triploid cultivars,
- Primula acaulis types (varieties of colors which are difficult to fix in seed varieties),
- Petunia wild species x seed strain,
- Gerbera wild species x seed strain (Verbena).

25. Clonal varieties, due to their short history in Japan, are mostly obtained from European and American companies or breeders under agreements granting sole sales rights for such varieties in Japan. This is due to the particular climatic pattern in Japan which is completely different from that of western countries. It is necessary to test varieties for one full year. The following features are very important in Japan:

- color - this must suit Japanese taste (foreigners say it must be a "Japanese color");
- high cut flower productivity;
- earliness;
- disease resistance;
- superiority to competing varieties.

The above features are thoroughly checked before beginning negotiations with breeders.

26. An alternative approach is to test all selections made, for example, in the Netherlands, which are thought to be suited for Japan. Samples of all such items are grown under Japanese conditions and any items which are found to be suitable are further developed in Japan. This means that, after applying for PVP, all these items are only sold in Japan. It is very difficult to fully understand and to content with the special conditions which govern sales and the rapid change of varieties on the Japanese market.

III. SAKATA SEED CORPORATION'S BREEDING STRATEGY AND PVP

27. F_1 hybrids in vegetable species greatly outnumber F_1 hybrid flower varieties, but it is Sakata's aim to promote and encourage F_1 hybrid breeding on all important flower seed species. Needless to say, for open-pollinated cultivars PVP protection is virtually essential, but greater emphasis is being placed on F_1 hybrid breeding as a means of self-protection.

28. For bulbs, vegetatively reproduced plants, as in the case of open-pollinated flower seed cultivars, PVP protection is very important. However, at present, the life span of any given variety is very short due to the rapid change in consumer taste. This fact and the high cost of breeding constitute a major problem and obstacle, discouraging many potential breeders from creating worthwhile new varieties.

29. In order to breed cultivars for overseas markets, the breeder must have a very broad knowledge of climatic conditions, consumer trends, the opinions of growers, etc. in foreign markets. It is very difficult for any breeder to obtain a thorough knowledge of the above aspects and this is a further problem.

30. The conclusion is that it is necessary to breed varieties in species with a long life span and to set breeding goals with long life span in mind.

ANNEX I

Outline of Flower Production in Japan According to Districts

1. **Hokkaidô District** Dfb

Farthermost north island in Japan. Winters are very severe with heavy snows. Summers are comparatively cool and dry. Horticultural production is relatively new. The spring season is colder than in the Netherlands. The main cut flower items grown and shipped during summer and autumn are: Carnation, Gypsophila, Sandersonia, Cosmos, freesia, lily, snapdragon.

2. **Tôhoku District** Cfa

The climatic conditions are very similar to Hokkaidô, but possibly just slightly warmer. Summers are generally cool and dry. It is also a relatively new growing area for flower items. Main cut flowers items grown and shipped during summer and autumn are: Gentiana, Eustoma, stock, carnation, freesia, Alstroemeria, pansy.

3. **Nagano District** Cfa

Located in a mountainous area, the so-called Japan Alps, summers are cool and dry. Altitudes vary according to location and growers are able to take advantage of varying altitudes and produce a very wide range of cut flowers and pot plants. A very old and important production area for cut flowers and pot plants due to its proximity to large market areas such as Tokyo, Nagoya, Osaka and other large cities.

Cut flowers: Delphinium, Eustoma, stock, carnation, Callistephus, Alstroemeria, Gypsophila, herbaceous paeony, chrysanthemum, rose, Limonium, Lilium Formo-Longo.

Pot plants: Kalanchoë, Cyclamen, Gentiana, etc.

4. **Kantô District and Pacific Ocean Belt** Cfa

District with many consumers and high demand. Abundant labor makes labor-intensive horticultural operations possible throughout the year. Cut flowers, pot plants and bedding plants are produced, as are other items which are not suited for long distance transportation. As a result of the hot mid-summer, many cool climate plant items are grown at high elevation and brought back in the autumn for final growing.

Cut flowers: Celosia, Helianthus, Gladiolus, freesia, tulip, lily, sweet pea, rose.

Pot plants: Hydrangea, Clematis, Primula, Poinsettia, Pelargonium, New-Guinea impatiens, orchid.

Bedding plants: pansy, Petunia, Impatiens, Begonia, Salvia, Vinca, marigold, Dahlia.

5. **The so-called "Warm Area"; it includes large areas on the Pacific Ocean side, in Shikoku and Kyûshu districts** Cfa

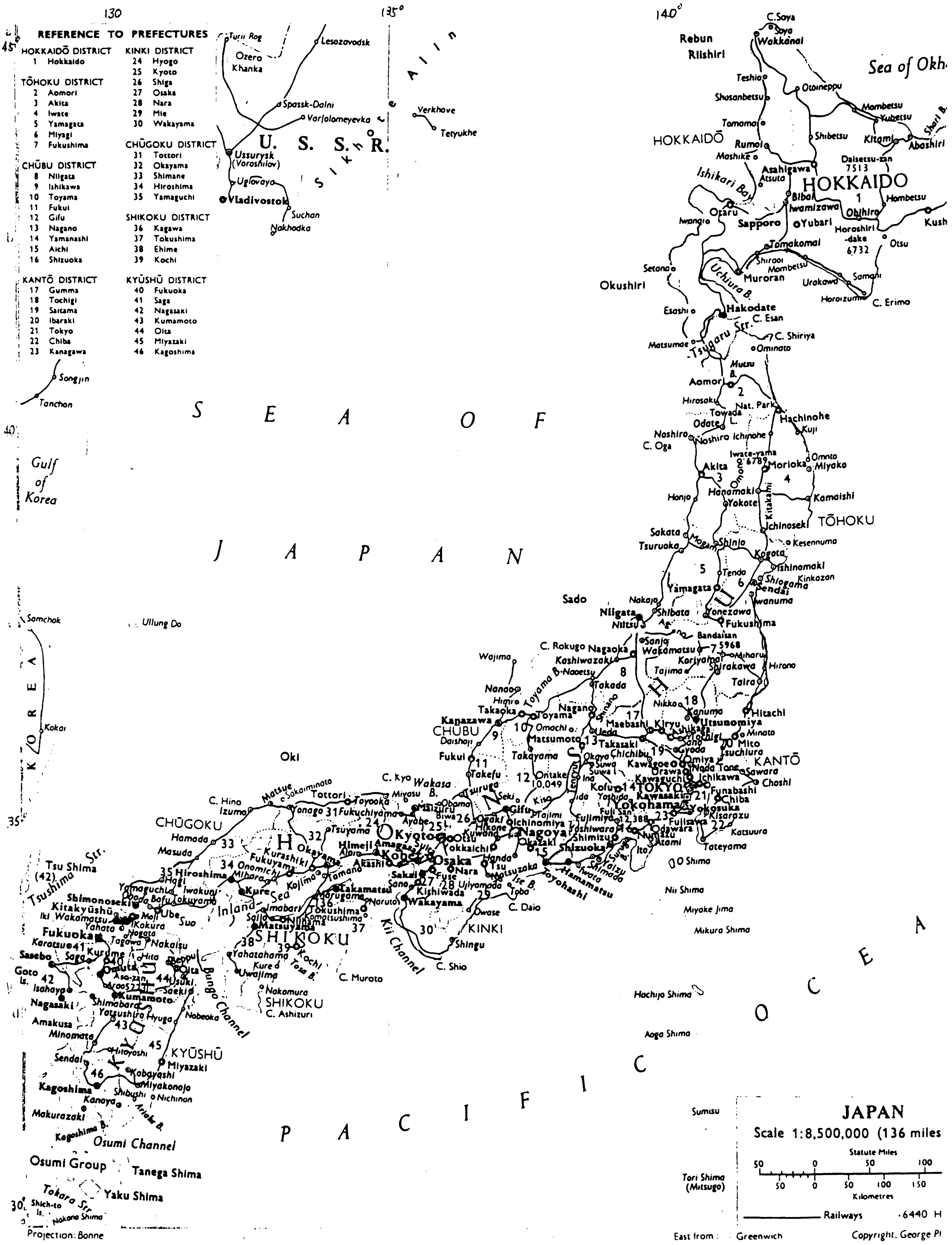
Mild winters; many of the areas in this district are frost-free. Winter crops, mainly cut flowers have always been grown. Products are shipped all over the nation, mainly to large cities. Flowers are grown outdoors, under vinyl (plastic) houses or in greenhouses.

Cut flowers: chrysanthemum, carnation, rose, lily, tulip, freesia, sweet pea, Limonium, Eustoma, Delphinium, Gypsophila.

Pot plants: Foliage plants, Anthurium, Spathiphyllum, orchid.

6. **Sea of Japan Coastal District** Cfa

Also called the "Backyard of Japan." Summers are hot and the heavy snowfall in winter makes the District unfit for cut flower production. For this reason, flowering bulbs, such as tulips, lilies and Narcissus are produced extensively.


REFERENCE TO PREFECTURES
HOKKAIDŌ DISTRICT
1 Hokkaido
TŌHOKU DISTRICT
2 Aomori
3 Akita
4 Iwate
5 Yamagata
6 Miyagi
7 Fukushima
CHŪBU DISTRICT
8 Niigata
9 Ishikawa
10 Toyama
11 Fukui
12 Gifu
13 Nagano
14 Yamanashi
15 Aichi
16 Shizuoka
KANTŌ DISTRICT
17 Gumma
18 Tochigi
19 Saitama
20 Ibaraki
21 Tokyo
22 Chiba
23 Kanagawa
KINKI DISTRICT
24 Hyogo
25 Kyoto
26 Shiga
27 Osaka
28 Nara
29 Mie
30 Wakayama
CHŪGOKU DISTRICT
31 Tottori
32 Okayama
33 Shimane
34 Hiroshima
35 Yamaguchi
SHIKOKU DISTRICT
36 Kagawa
37 Tokushima
38 Ehime
39 Kochi
KYŪSHŪ DISTRICT
40 Fukuoka
41 Saga
42 Nagasaki
43 Kumamoto
44 Oita
45 Miyazaki
46 Kagoshima
U. S. S. R.
Sea of Okh
HOKKAIDO
TŌHOKU
CHUBU
KANTŌ
KINKI
CHŪGOKU
SHIKOKU
KYŪSHŪ
SEA OF JAPAN
PACIFIC OCEA
Gulf of Korea
KOREA
Tokyo
Yokohama
Osaka
Kyoto
Kobe
Nagoya
Sapporo
Hakodate
Sendai
Hiroshima
Fukuoka
Kagoshima
JAPAN
Scale 1:8,500,000 (136 miles
Statute Miles
Kilometres
Railways
Projection: Bonne
East from Greenwich
Copyright. George Pl

ANNEX II

Statistics of Flower Business in Japan

A: Wholesale of cut flowers by stem count and sales amount during 1992

Item	Quantity x 1000	Sales Amount x Million Yen	Rank in order of sales amount
Chrysanthemum	1,608,940	86,561	1
Carnation	484,060	22,266	3
Rose	327,380	25,502	2
Lily	156,750	21,380	4
Formo-Longo	53,740	5,841	
Others	103,010	15,539	
Sweet Pea	115,060	5,189	10
Limonium	113,150	7,490	7
Gypsophila	111,630	10,917	5
Gerbera	89,860	3,369	13
Eustoma	82,860	9,592	6
Gentiana	78,010	6,209	8
Tulip	77,120	5,807	9
Freesia	74,330	3,431	13
Stock	67,100	3,455	12
Gladiolus	53,680	3,022	14
Alstroemeria	39,760	3,661	11
Calendula	32,800	-	
Iris, Dutch	32,670	2,077	
Narcissus	32,000	-	
Anthirrhinum	20,800	-	
T O T A L	5,036,290	294,622	

B: Wholesale of pot plants by pot numbers and sales amount during 1992

Item	Quantity x 1000	Sales Amount x Million Yen	Rank in order of sales amount
Primula (Total)	12,650	2,987	3
Orchid	11,470	22,389	1
Cyclamen	9,930	4,078	2
Cineraria	4,830	1,102	6
Begonia elatior	4,780	2,109	5
Kalanchoë	4,500	1,070	8
Poinsettia	3,710	2,440	4
Pelargonium	3,560	761	9
Dianthus	2,690	648	11
Saintpaulia	2,590	633	12
Hydrangea	1,770	1,077	7
Gentiana	1,470	358	13
Hibiscus	1,190	668	10
T O T A L	118,130	94,403	

C: Wholesale of bedding plants

Item	Quantity x 1000	Sales Amount x Million Yen
Pansy	40,400	
Marigold	12,100	
Salvia	12,100	
Vinca	2,160	
T O T A L	174,810	10,436

ANNEX III

Botanical Taxa used in the Flower Business in Japan; Mode of Propagation; Applicability of Plant Variety Protection; Type of End Product; Production in 1992

Explanation of columns:

Column I: Botanical taxa in Latin

Column II: Mode of propagation: the most popular mode of propagation is indicated by "●" in the following columns ("o" indicates an alternative mode or propagation which is less important than that indicated by ●):
- Column a: F_1 hybrid
- Column b: open-pollinated
- Column c: vegetatively pollinated

Column III: Applicability of plant variety protection
- Column d: botanical taxa indicated by an "o" in this column are protected by PVP in Japan
- Column e: number of currently protected varieties in Japan; the figure between brackets indicates the number of protected varieties which have been bred by Sakata.

Column IV: Type of end product: main end products and end products of less importance are indicated by an "●" and "o" respectively in the following column:
- Column f: cut flowers
- Column g: pot plants
- Column h: bedding plants

Column V: Production in 1992
- Column i: number of stems or pots delivered to wholesale market (1,000 stems or pots)
- Column j: sum of wholesale price in one yen

I	II			III		IV			V	
	a	b	c	d	e	f	g	h	i	j
Ageratum houstonianum	●					o	o	●		
Alstromeria Hyb.			●	o	65(5)	●	o		39,760	3,661
Allium			●	o		●		o		
Anigozanthus			●			●	o			
Antirrhinum majus	●		o	o	9	●	o	o	20,800	
Aster ericoides			●	o		●		o		
Anemone coronaria		●				●		●		
Begonia semperflorens-Hyb.	●						o	●	P	
Knollen begonien-Hyb.	●				18		●	o	4,780	2,109
Bellis perennis	o	●		o			o	●		
Brassica campestris	●					●		o		
Brassica oleracea	●				9		o	●		
Calceolaira Hyb.	●						●	o		
Calendula officinalis		●		o	19(6)	●	o	o	32,800	
Callistephus chinensis		●		o		●	o	o		
Campanula medium	●	o		o		●	o			
Capsicum annum	o	●				o	o	o		
Carthamus tinctoris		o		o	4(3)	o				
Catharanthus rosea(=Vinca)		●		o	1		o	●	P 21 60	323
Celosia		●		o	18(11)	o	o	o		
Centaurea		●		o		o		o		
Chrysanthemum morifolium			●	o	192	●	o	o	1608,940	86,561

I	II			III		IV			V	
	a	b	c	d	e	f	g	h	i	j
Chrysanthemum maximum	o	●					o	o		
Clivia minata		o	●	o			●			
Coleus blumei		●					o	●		
Cosmos bipinnatus		●		o	9 (2)			o		
sulphureus		●		o	3 (3)		o			
Cyclamen persicum	●	o		o	5		●	o	9,930 P	4,078
Clematis			●	o	12 (1)		●	o		
Dahlia	o	●			11		o	●		
			●	o		o		●		
Delphinium	o	●			1	o		●		
			●	o		●				
Dianthus chinensis etc.	●	o			14	o	o	●	2,690 P	648
caryophylus	●	o			295 (24)		●	o		
(Inc. Hyb.) "			●	o		●	o		4 4,060	22,266
Escholtzia ĉlifornica		o						o		
Euphorbia (=Poinsettia)			●		14				3,710 P	2,440
(=Lisianthus) Eustoma russellianum	●	o		o	18 (1)	●	o		82,620	9,592
Exacum affine		●					o			
Freesia Hyb.	●					o				
			●	o	15 (3)		o	●	74,330	3,431
Gazania splendens		●					o	●		
GEntiana Hyb.	●			o	52	●			78,010	6,209

I	II			III		IV			V	
	a	b	c	d	e	f	g	h	i	j
Gentiana Hyb.			●	o		o	●		1,470	358
Gerbera Hyb.	◉						◉			
Gerbera			◉	o	48(11)	◉			89,860	3,369
Gloriosa			◉	o		◉	o			
Gladiolus				o				o	56,680	3,022
Godetia	◉	o		o	7 (5)		o	o		
Gypsophila elegans		◉				o		◉	111,630	10,917
paniculata			◉	o		◉				
Hippeastrum(=Amaryllis)			◉	o		o	o			
Helianthus annuus	◉	o		o	3	◉	o	o		
Hibiscus moscheutos	◉				1			◉		
rosa-sinensis			◉	o			◉		P 1,190	668
Hydrangea				o	27				P 1,770	1,077
Impatiens walleriana	◉						o			
New Guinea Hyb.			◉	o	40(27)					
Iris Hollandica-Hyb.			◉	o	7	◉		o	32,670	2,077
" kaempferi			◉					o		
Kalanchoe blossfeldiana			◉	o	15		◉		4,500	1,070
(Sweet Pea) Lathyrus odoratus		◉		o	1 (1)	◉		o	115,060	5,189
Liatris		◉				◉		o		
Lilium Formo=Longo	◉			o		◉			53,740	5,841
Oriental-Asiatic			◉	o	111 (2)	◉	o	o	103,010	15,539

I	II			III		IV			V	
	a	b	c	d	e	f	g	h	i	j
Limonium sinuatum		●				●			113,150	7.490
Hyb.			●	o	27	●				
Lobelia erinus		●					●			
Lobularia maritima		●						●		
Mathiola inca (=Stock)		●		o	93(5)	●	o	o	67,100	3,455
Osteospermum ecklonia			●	o			o	o		
Papaver nudicaule	o	o				●		o		
Pelargonium	●				30		●	o	P 3,560	76
			●	o		o	●			
Petunia Hyb.	●		o	o	6		o	●		
Pharbitis nil		●		o	3 (3)		o	●		
Platycodon grandiflorum	o	●		o	1 (1)	●	o	o		
Portulaca grandiflorum	●	o						●		
Primula vulgaris	●			o	21 (2)		●	o	P 12,650	2,987
Narcissus			●			●	o	o	32,000	
Nerine			●			●	o			
Ranunculus asiaticus			●	o	5 (5)	●	o	o		
	●						●	o		
Rose			●	o	344 (4)	●	●	●	327,380	25,502
Saintpaulia ionantha			●	o	23		●		P 2,590	633
Salvia splendens		●					o	●	P 12,100	
Senecio cruentus(=Cineraria)	o	●			1.		●		P 4,830	1,102

I	II			III		IV			V	
	a	b	c	d	e	f	g	h	i	j
Sinningia speciosa (=Gloxinia)	●	o					●			
Solidaster x			●	o		●				
Sandersonia aurantiaca			●			●				
Tagetes erecta	●	o				o		●	12,100	
Patula	o	●					o	●		
Torenia fournieri		●					o	●		
Tulip			●	o	37	o	o	●	77,120	5,807
Verbena		●	o	o	5		o	●		
Viola wittrockiana	●				3	o	o	●	40,400	
Zinnia elegans	o	●			1	o	o	●		
Zantedeschia (=Calla)			●	o	1	●	o	o		
Zygocactus				o	15					
Orchid										
Cymbidium			⊙	o	202	o	⊙			
Dendrobium			⊙	o	34	o	⊙			
Cutflower			⊙	o		o			107,430	16,554
Pot Plants			⊙	o			o		P 11,470	22,389

F O U R T H S E S S I O N

PLANT VARIETY PROTECTION IN THE ASIAN AND PACIFIC REGION

THE ACHIEVEMENTS OF AND PROSPECTS FOR PLANT BREEDING IN CHINA

Speaker: Mr. Zhuang Qiaosheng, Research Professor, Institute of Crop Breeding and Cultivation, Chinese Academy of Agricultural Sciences (CAAS), Beijing, China

REGULATIONS ON SEED MANAGEMENT AND THE CURRENT SITUATION OF THE PROTECTION OF NEW PLANT VARIETIES IN CHINA

Speaker: Mr. Wang Keping, Senior Agronomist, Head, China National Seed Administration Station, Ministry of Agriculture, Beijing, China

THE CURRENT SITUATION OF THE PLANT BREEDING AND SEED INDUSTRIES IN BANGLADESH; THE POLICY ON THE PROTECTION OF NEW VARIETIES

Speakers: Dr. Muhammed Nasiruddin, Chief Plant Breeder and Head of the Genetic Resources and Seed Division, Bangladesh Rice Research Institute, Gazipur; Dr. Tulsi Das, Chief Plant Breeder, Plant Breeding Division, Bangladesh Rice Research Institute, Regional Station Sashangacha, Comilla

THE CURRENT SITUATION OF THE PLANT BREEDING AND SEED INDUSTRIES IN INDIA; THE POLICY ON THE PROTECTION OF NEW VARIETIES

Speaker: Dr. Mangla Rai, Assistant Director General (Seeds), Indian Council of Agricultural Research, New Delhi

THE CURRENT SITUATION OF THE PLANT BREEDING AND SEED INDUSTRIES IN INDONESIA; THE POLICY ON THE PROTECTION OF NEW VARIETIES

Speaker: Ir. Ferial Lubis (Mrs.), International Cooperation Bureau, Ministry of Agriculture, Jakarta

[Cont'd]

THE BREEDING AND SEED PRODUCTION OF PADI AND FRUIT CROPS IN MALAYSIA

Speakers: Mrs. Norma Othman, Agriculture Officer, Commodity Development Branch, Department of Agriculture, Kuala Lumpur; Mrs. Fatimah Bt. Md. Anwar, Agriculture Officer, Commodity Development Branch, Department of Agriculture, Pulau Pinang

THE CURRENT SITUATION OF THE PLANT BREEDING AND SEED INDUSTRIES IN PAKISTAN; THE POLICY ON THE PROTECTION OF NEW VARIETIES

Speakers: Dr. Bashir Ahmed Malik and Mr. G. Rachid Anwar, National Agricultural Research Centre, Islamabad; Dr. Akhlaq Hussain and Mr. Muhammed Ibrahim, National Seed Research Department, MINFA, Rawalpindi

THE CURRENT SITUATION OF THE PLANT BREEDING AND SEED INDUSTRIES IN THE PHILIPPINES; THE POLICY ON THE PROTECTION OF NEW VARIETIES

Speakers: Dr. Manuel L. Logroño, University Researcher and Maize Breeder, Institute of Plant Breeding, University of the Philippines, Los Baños College, Laguna; Ms. Erlinda Pili-Sevilla, Chief, National Seeds Quality Control Services, Bureau of Plant Industry, Department of Agriculture, San Andres, Manila

THE CURRENT SITUATION OF THE PLANT BREEDING AND SEED INDUSTRIES IN THE REPUBLIC OF KOREA

Speaker: Dr. Seonghee Lee, Senior Researcher, Crop Experiment Station, Rural Development Administration, Suweon

THE STATUS OF THE SEED INDUSTRY IN THAILAND

Speakers: Dr. Vichitr Benjasil, Deputy Director-General, Department of Agriculture, Ministry of Agriculture and Cooperatives, Bangkok; Dr. Prasoot Sittisuang, Director, Rice Research Institute, Department of Agriculture, Ministry of Agriculture and Cooperatives, Bangkok

Chairman: Mr. Barry Greengrass, Vice Secretary-General of UPOV, Geneva, Switzerland

THE ACHIEVEMENTS OF AND PROSPECTS FOR PLANT BREEDING IN CHINA

1. China has a long history in agriculture. Its plant breeding work started about 1910. Over more than 40 years since the founding of the People's Republic of China, China has gradually established an integrated system of plant germplasm resources, breeding, extension and marketing from central to local levels with a large professional team working for it. By now, more than 300,000 plant germplasm resource samples have been collected, of which more than 200,000 have been put into the National Gene Bank for long-term conservation. Nearly 5,000 new varieties and new hybrids from 40 crop species have been bred and released for commercial production. For the main food and cash crops, 4 to 5 times variety turnover have taken place and each cycle of varietal replacement leads to a 10 to 30% yield increase and an improvement in crop quality and resistances to diseases and pests. Significant breakthroughs in the field of short strawed breeding, radiation breeding and utilization of heterosis have made China one of the advanced countries in the field of plant breeding and its application.

2. Since China is now experiencing its special stage of transformation from the planned economy to socialist market economy, more attention should be paid to the further advancement of the crop germplasm resource study, to plant breeding work and the extension of new varieties with high-yielding capacity, good quality and multi-resistance to stress. Theoretical and methodological research in plant breeding should also he strengthened. New crop varieties should be protected by intellectual property rights and other specialized regulations so that new contributions to the development of agriculture for higher yield, higher quality and higher efficiency can be made and the step from a self-sufficient economy to that of an economy providing comparatively high standard of living be realized.

THE SIGNIFICANCE AND FUNCTION OF PLANT BREEDING IN AGRICULTURAL PRODUCTION

3. Agriculture is the basis of our national economy. Good plant varieties are important agricultural production materials as well as internal factors that determine the high yield and good quality of farm products. However advanced the tools or however modern the technology that are used are, crop production can only be improved through the introduction of better varieties. Over more than forty years, due to the great attention paid by the governments at different levels, many significant achievements have been made in our plant breeding and extension work so that the problem of feeding 1.1 billion people is generally solved.

4. China has a long history in agriculture. It started its crop breeding work in the very early times. After the founding of the People's Republic of China, especially during the recent 14 years of reformation and opening-up to the world, China has gradually established from central to local levels an integrated system of crop germplasm resource study, breeding, extension and marketing, with a large scientific and technological team working for it. The system pushed forward the commercialization and modernization of crop seed management and contributed a lot to the development of sustainable and stable agriculture. According to incomplete statistics, more than 5,000 varieties from 41 crop species have been bred and released for production during the years from 1949 to 1992. Most of the new varieties have desirable economic and biological characters, can effectively adapt themselves to the natural and

production environments and have good resistance to unfavourable conditions, so they are high-yielders.

(i) Taking rice as an example, in the early 1950s, rice producers mainly grew traditional farmers' varieties. Later, they gradually changed to the use of new varieties. In the 1960s, the rep- lacement of tall varieties by the short ones, supported by other husbandry measures, brought about an increase of rice yield per mu (= 6,667 a = 1/15 ha) from 175 kg to 200 kg (2,625 to 3 t/ha). In the early 1970s, China succeeded in developing and breeding a complete set of three lines (A, B and R lines) of Indica hybrid rice and soon they were used in rice production. From 1976 to 1992, the total accumulated acreage of hybrid rice was more than 2 billion mu (1,33 million km^2) with a gain in yield amounting to more than 50 billion kg of rice.

(ii) Wheat is the second most important food crop in China next to rice. The yield of wheat was only 42.5 kg per mu (0.637 t/ha) in 1949. As a result of the successive development and release of rust-resistant and high-yielding varieties, the wheat varieties have been renewed four times and the yield per mu is getting higher and higher. In 1991, the yield was 208 kg/mu (3.12 t/ha), 4.8 times higher than that in 1949.

(iii) In the early 1950s, synthetics were mainly used in maize production. But after the 1960s, due to the comprehensive utilization of heterosis hybrids from single cross combined with other hybrids from double crosses, triple crosses and top crosses, the acreage of hybrid maize reached 150 million mu (100,000 km^2) in 1975, and was further expanded in 1990 to 220 million mu (146,666 km^2), accounting for more than 80% of the total maize acreage. The average yield of maize per mu was raised to 308 kg (= 4.62 t/ha).

(iv) As for cotton, the yield of ginned cotton used to be only 20 kg/mu (0.3 t/ha) or 30 kg/mu (0.45 t/ha) when the American upland cotton varieties were grown in the past. In the 1960s, China started to release and extend its own improved cotton varieties. Varietal replacement has been carried out three times in the main cotton growing areas, resulting each time in a steady improvement of yield and quality. In 1984, the average yield per mu was 60.5 kg (0.908 t/ha) and total production was over 100 million dan, which was not only sufficient for the domestic market, but also provided some surplus for export purposes.

(v) Progress has also been made in the breeding and extension of other food and cash crops.

5. Since 1983, the breeding of new crop varieties has been listed as the priority research program of our country. Agricultural research, education and extension institutions are organized by the central government to work together to create new food and cash crop varieties and hybrids.

(i) Sixty-two new varieties of conventional rice have been bred and are grown on nearly 100 million mu (66,666 km^2); 33 new hybrid rice varieties have been bred. This has not only speeded up the rate of varietal replacement, but has also solved the problem of compatibility between early and middle rice, and made a great contribution to the expansion of the acreage of hybrids grown in China.

(ii) For wheat, 42 new varieties with high and stable yield have been bred and are grown on nearly 80 million mu (53,333 km^2).

(iii) Forty-three new disease-resistant hybrids of maize have been bred and are found to have notable benefits for the area where they are grown. The lysine content in the grain of new high lysine maize is 2.1 times higher than that in the ordinary one. And the new maize varieties are not subject to

attack by ear rot and have reached the advanced level of the world. The success in breeding super-sweet maize not only adds new varieties for the domestic market, but also contributes to exports once they have been processed and canned.

(iv) For cotton, 23 new varieties have been bred, dramatically up-grading fibre quality. All of the 23 varieties are characterized by their high yield and strong disease resistance, and some of them have come close to the level of American high-quality cotton varieties.

(v) Forty-two new varieties of soybean have been bred which are grown on an aggregate area of 24 million mu (16,000 km^2). The breeding of 'Dongnong No. 36', a super early ripening variety, has enabled the frontier of China's soybean growing area to move more than 100 km northwards.

(vi) Nine new varieties of low erucic acid rapeseed have been bred and are grown on an area of 3 million mu (2,000 km^2).

(vii) In addition, newly bred varieties of sweet potato, peanut, tea and bast fibre crops are also being marketed and applied in production.

6. In forestry, a number of improved populations and varieties have been developed and provided to the fast growing of forest bases and famous-special quality forest bases as breeding plantlets. In recent years, the afforested area has been 3,290,000 ha and the annual incremental benefit is 215,000,000 yuan RMB. Five factories for the tissue culturing and containerizing of plantlets have been set up in the south, north, northeast and northwest of China. The plantlet growth period is shortened by three quarters. A system of cultivation technology for forest fast-growing and high-yielding quality varieties has been developed which raises the intensive cultivation of man-made forests in China to a new level.

7. It has been proved in practice that good plant varieties play a very important role in agricultural production. The work of breeding and promoting good new varieties is a way to increase yields that needs little investment and has low energy consumption. It can greatly improve agricultural productivity.

MAIN ACHIEVEMENTS IN BREEDING AND RELEASE OF PLANT VARIETIES IN CHINA

8. China is a big agricultural country and climatic and soil conditions are very complicated. It is one of the important centers of origin of many plants (crops). The industrious and ingenious Chinese working people have accumulated extremely valuable experience in the selection and utilization of varieties. After the founding of new China, a rationally distributed scientific profession with all necessary disciplines related to plant breeding has been formed gradually. By close coordination with the professionals of seed management and business, many important achievements have been attained in the study of genetic resources, breeding and promotion of improved varieties, propagation and management of elite seeds, etc.

Genetic Germplasm Resources of Plants

9. Plant genetic resources are the material base for varietal improvement and are the wealth of mankind. Today, with the great development of the life sciences, the importance of plant genetic resources has been increasingly realized. The scientists hold that the development of agriculture in the future will, to a great extent, depend on the levels of control and utilization

of plant germplasm resources. Thus, some developed countries pay increased attention to research work on germplasm resources. By combining such research with modern biotechnology, they have made an important progress in this field.

Collection of Local Plant Varieties in China

10. In the middle and late 1950s a nation-wide collection activity for field crop germplasm resources was launched. About 200,000 accessions of nearly 50 species of field crops were collected at that time. In August 1978, the Institute of Crop Germplasm Resources of the Chinese Academy of Agricultural Sciences was established. Afterwards some crop germplasm resources institutions were established one after another in provincial, autonomous region and municipality academies. A widespread supplementary collection of crop germplasm resources was thus made all over the country. About 100,000 accessions of 60 crops were collected. The amount of crop germplasm resources in China has now reached 300,000 accessions, which stored amount is one of the greatest in the world.

11. Towards the end of the sixth Five-Year Plan period, searches for crop germplasm resources were made successively in Tibet, Yunnan, Shennongjia, the areas of the three Gorges along the Yangtze River, and Hainan Island. More than 10,000 new germplasm resource accessions were collected, including some rare and endangered germplasm. For instance, during the period of search in Yunnan, over 4,000 accessions of various germplasm resources were collected. Rice germplasm with the characteristics of broad adaptation, strong resistance to environmental stress, big spikes and kernels and good quality were discovered. It has provided a scientific basis for the assertion that China's Yunnan is one of the centers of origin of rice in the world.

12. In addition, some excellent Yunnan wheat germplasm with high protein content and big kernels was collected. Twenty-three varieties of bread wheat were discovered for the first time, including 15 varieties which had not been reported before either at home or abroad. When the search was conducted in the area of the Three Gorges in Sichuan Province, a total of 1,774 accessions of crop seeds and vegetative propagating material were collected including some rare and excellent germplasms, such as wild buckwheat, wild soybean, big cucumber and Ma glutinous millet.

Conservation of Plant Genetic Resources

13. In order to strengthen the work on the conservation of plant genetic resources, China has established a modern national crop germplasm bank with a conservation capacity of 400,000 accessions. It is a long-term storage center for germplasm resources, and the center of germplasm specimen and seed data management in China. It is also one of the biggest in capacity and most modern gene banks in the world. It now stores 204,000 accessions of 160 crops. They belong to 28 families, 160 genera, more than 400 species (including subspecies), 580 botanical varieties, and 448 types. Data of the crop germplasm resources has been put into a computer. An information management system for national crop germplasm has been established. It includes a database for gene bank management, a database for the evaluation of characteristics, and a database for the exchange of germplasm resources both at home and abroad. Standardized management of the gene bank has been realized. Some medium-term gene banks for crop and forage grass germplasm resources have been built in Hangzhou, Gouangzhou and Harbin. Thus, a network with rational distribution and long and medium-term storage conditions has

been formed in China. In addition, more than 20 perennial crop germplasm nurseries have been established, such as wild rice, wild cotton, sweet potato, ramie, hydrophytic vegetables, wild peanuts, fruit trees, forest trees, tea, mulberry, etc.

14. By observing carefully the quality of seeds maintained at the bank and cryopreservation techniques, the national and local research institutions have made systematic studies on drying length for different kinds of seed, the effects of different kinds of packing materials on seed vitality, the effects of moisture absorption by seeds and different temperatures on the seed drying rate, germination conditions and method for different kinds of crop seeds. Important progress and scientific accomplishments have been made in these fields.

Identification and Evaluation of Plant Genetic Resources

15. By screening for quality, resistances to diseases and pests and to stress environments, and as a result of studies on testing methods and basic research, more than 4,000 accessions of excellent germplasms have been selected, of which over 200 have been provided as breeding material and more than 70 have been used directly in agricultural production. For instance, through the evaluation of salt tolerance, 'Lansheng' and other rice varieties have been selected, and their planting area has reached 100,000 mu (6.600 ha) in Jiangsu, Shandong, Henan and Tianjin provinces and municipality. Through the evaluation of cold tolerance, 496 accessions of wheat material have been selected, of which 298 were used as basic material for breeding, 174 were used directly as parents, 9 were worthy of direct use. After the evaluation of their resistance to diseases and pests, over 100 varieties of wheat and millet have been provided for use in breeding. Through quality testing, some barley varieties with low protein contents for brewing, and some triticale and durum wheat varieties with high protein content have been selected and used in breeding programs and in production.

Basic Research on Plant Genetic Resources

16. Through comprehensive research into the botany, relatedness, ecological characteristics and geographical distribution of Chinese cultivars of rice and classification methods for Chinese cultivars of rice have been put forward. They have provided the basis for the documentation of rice germplasm resources all over the country. As a result of the study of the classification and evolution of major crop genetic resources in Tibet, 105 new varieties of barley, 2,000 varieties of wild barley and 40 varieties of bread wheat have been discovered, among which were 15 varieties which had not been previously reported either at home or abroad. In an evaluation of the "sources" of special characteristics in wheat, the analytical method of pedigree analysis has been combined for the first time with gibberellic acid reaction on main dwarf varieties maintained in the gene bank and used in agricultural production in order to analyse and classify their sources of dwarfism. Six new dwarfing sources have been discovered by testing and monosomic analysis. By studying the composition and utilization of didiploids of Triticum aegilops, two wheat germplasm which can make the F set of chromosomes of Triticum aegilops to double naturally have been discovered for the first time in China. Twenty-two didiploids of Triticum aegilops have been made; two of them have been made for the first time in the world.

International Exchange of Plant Genetic Resources

17. Through international cooperation and exchanges in science and technology, many crop germplasm resources have been introduced from abroad, while 12,000 accessions of 62 crops have been provided to 42 countries, regions and international organizations. Through testing and evaluation of different kinds of crop germplasm introduced from abroad, much excellent germplasm has been selected for use in breeding and production. In order to speed up the isolation, testing and quarantine of crop germplasm, national centers for quarantining introduced crop germplasm have been established in Beijing and Xiamen, in addition to the quarantine stations established at export-import ports.

Breeding of New Plant Varieties

18. Since the founding of new China, the research work of most agricultural scientists has changed from the selection and evaluation of local varieties and the introduction and systematic selection of varieties to hybrid breeding. By the 1970s, hybrid breeding has become the main method in breeding programs and important progress has been made in this field. According to preliminary statistics, local varieties and introduced varieties used in production decreased from 33% in the 1950s to 5% in the 1970s while the varieties developed by systematic selection decreased from 41% to 28%. But the hybrids increased from 26% to 61%. Meanwhile, the theory and method associated with heterosis, radiation-induced variation, wide crosses, tissue culture and cell engineering were used extensively to expand the range of variation, reduce the breeding duration, increase the efficiency of selection, and open up new prospects in crop breeding.

(i) Breeding of dwarf varieties.- In order to overcome the rice lodging problem caused by typhoon in rice growing areas along the coast of South China, the dwarf variety 'Ai-Jiao-Nan-Te' was selected as early as 1956. By using the 'Ai-Zai-Zhan' source of dwarfism to make a sexual cross, the first dwarf rice variety 'Guang-Chang-Ai' was developed in 1959. Since then, many dwarf rice varieties have been developed, such as the 'Zhen-Zhu-Ai' and 'Guang-Lu-Ai No. 4.' These varieties have been distributed in the rice growing areas in the South. By discovering two new rice dwarfing sources 'Xue-He-Ai-Zao' and 'Han-Gu 2,' the material base for solving the problem of a single dwarfing source for China and Southeast Asia has been provided. The dominant dwarfing gene ch 84133 which was found recently in millet has provided good breeding material for developing varieties with lodging resistance, suitable for close planting. On wheat, many dwarf and semi-dwarf varieties have been bred by researchers over many years. The yield potential has obviously been increased. Generally, the yield now reaches about 500 kg per mu (7.5 t/ha).

(ii) Breeding for high-yielding and superhigh-yielding varieties.- By completing "three lines" of rice in the 1960s, many new high-yielding combinations of hybrid rice have been selected. For instance, the yield of 'Shan/You 63' and others is in general 50 kg higher than the control. Through the breeding and distribution of conventional varieties, such as 'Te-Qing No. 2,' the maximum yield can reach over 800 kg per mu (12 t/ha). Thus, the new pattern of catching up with and surpassing earlier improvements was formed between conventional varieties and hybrid rice under field conditions. In recent years, breeding superhigh-yielding varieties has been listed by breeders as one of the main objectives.

(iii) Breeding for disease and insect resistances.- Some new varieties developed in recent years have not only resistance to one or two diseases and insects, but also multiple resistances to most of the important pests. Taking disease resistance breeding as an example, rust resistance breeding is one of the main objectives in major wheat growing areas. To develop and spread the varieties with resistances to different kinds of physiological races, the damage caused by rust has been controlled effectively. Vegetable varieties with resistance (tolerance) to as many as two main diseases have been bred. For instance, the tomato variety 'Zhong-Shu No. 5' has high resistance to tobacco mosaic virus and tolerance to cucumber mosaic virus. The cucumber varieties 'Jin-Za No. 3 and 4' have resistances to downy mildew, Fusarium wilt and powdery mildew; the new cotton variety 'Zhong/Mian No. 12' has resistances concurrently to Fusarium wilt and Verticillium wilt. The new cotton line 'Chuan 98' with resistance to the major cotton insects has also been bred. Some new soybean varieties developed for different kinds of ecological regions and with resistance to mosaic virus, leaf spot, cyst nematode and pod borer have been used in field production.

(iv) Quality breeding.- Since the 1980s, China has paid more attention to quality breeding. A batch of varieties with good grain quality for special purposes began to be used in field production. They have not only led to varietal diversification, but also increased the economic return. For instance, 'Hunan Soft Rice,' 'Liao-Yan 282,' 'Xiang-Wan-Xian No. 2,' etc., which were developed as major research thrusts in the Eighth Five-Year Plan, were awarded gold and silver medals respectively at the First China Agricultural Fair in 1992. Among them, 'Hunan Soft Rice' is an early Hsien (Indica) variety. Physio-chemical and quality analysis and flavor tasting have shown that the result is much better than crystal rice (trademark Taihe) and fragrant rice (trademark Golden Dragon) of Thailand, and American rice (trademark Jia-Guan). New rape varieties with low erucic acid and low glucosinolate contents have been bred. The contents of erucic acid in oil is below 1% and glucosinolates below 30 micromole/g. The planting area has reached 7.5 million mu (5,000 km^2), accounting for more than 10% of the total plantings of rape. Some barley varieties for brewing and feed have their own characteristics. The maize variety 'Zhong-Dan 206' is a variety with high lysine content. The lysine content of whole grains reaches 0.47%. The oil content of high oil content maize variety 'Nong-Da-Gao-You 1' reaches 8.2%. All these have come up to international research levels of their kinds.

(v) Breeding new varieties with comprehensive characteristics of high yield, good quality and multiple resistance.- For instance, by breeding and releasing the new cotton variety 'Zhong-Mian No. 12,' the characteristics of high yield, good quality and resistance to stresses have been properly combined, which enabled cotton production in China to advance with big strides. The annual planting acreage of the new cotton variety accounts for one third of the total plantings of cotton in the whole country. In addition, the new sugar beet variety 'Tian-Yan 302' has good performance, high sugar contents and strong resistance to diseases. The cultivated area covers 40% of the planting of sugar beet in China.

Study and Application of Plant Breeding Theories and Methods

19. The basic task of plant breeding in China is the comprehensive inter-disciplinary utilization of research findings; the application of systematic breeding, cross breeding, radiation breeding, the use of heterosis, wide crosses, biotechnology, etc. to create elite varieties and to serve the development of agricultural production.

(i) Cross breeding.- Cross breeding (i.e. conventional breeding) is the most common and the most productive breeding method both in China and abroad. Using cross breeding, many varieties of rice, wheat, cotton, soybean, etc. have been developed. These varieties account for more than 60% of all released varieties either in numbers of varieties or in planting acreage.

(ii) Use of heterosis.- Heterosis was recognized and applied by mankind very early. The Chinese agricultural scientists have made important breakthroughs in the study and use of heterosis. The completion of the "Three Lines" of Hsien (Indica) hybrid rice was realized successfully in 1973. This is a new leap in the development of rice. It not only opened a new path for increasing rice production, but also broke a new path for the use of heterosis in self-pollinated crops, and enriched the theory of genetic breeding. Following the hybrid rice, "Three lines" of rape of wild cabbage type were completed in 1986. A new combination 'Tai-You No. 2' was bred and has been planted commercially. This is another significant achievement in the use of heterosis in breeding in China and occupies a leading position in the world. The use of heterosis in wheat, cotton, millet, etc. has also made breakthrough advances. The use of heterosis and clones in poplar and other forest trees has achieved great successes.

(iii) Radiation breeding.- Important advances in China have been achieved by using the radiation technique to induce various mutations of plants and to select new varieties from them. According to statistics, more than 190 crop varieties have been bred, accounting for one third of their kind in the world. Using radiation-induced mutation, a number of superior varieties have been bred, such as the rice variety 'Yuan-Feng-Zao,' the wheat variety 'Fu 63,' the cotton variety 'Lu-Mian No. 1,' the soybean variety 'Ti-Feng 18,' the rape variety 'Gan-You No. 5,' and the peanut variety 'Ao-You 22'. All these have been used commercially in production, and have obtained good social and economic results.

(iv) Tissue culture and cyto-engineering.- Since the 1970s pollen culture and tissue culture have developed rapidly in China. N media with high inducing frequency and simplified media for potato, etc. have been developed. Tissue culture has been successfully used in more than 40 crops. Among them, wheat, triticale, maize, sugar cane, sugar beet, rubber, etc. have been successfully cultured for the first time in China. The new rice varieties 'Zhonghua No. 8., No. 9 and No. 10' are high-yielding varieties with high quality and blast-resistant genes. Their growing area is above 3 million mu (2,000 km^2). The growing area of the new wheat variety 'Jinghua No. 1' is over 1 million mu (667 km^2) and obvious economical benefits have been obtained. In recent years, factory production techniques for fast virus-free propagation have been developing rapidly and a new industry has been gradually formed. Plants of rice, barley, tobacco, citrus, cucumber, etc. have been generated by protoplast culture. New tobacco lines have been developed by interspecific somatic crossing and have been used in production. In recent years, the yellow dwarf virus resistance gene in Elytrigia intermedia has been successfully introduced into common wheat and translocation lines have been developed. Insect resistance genes have been transferred into cotton and expressed and new lines with resistance to cotton bollworm have been developed and entered the field demonstration stage, which has reached the advanced world level.

20. In addition, important progress has been made in research on and development of artificial, synthetic allo-octoploid triticale, of varieties developed from distant crosses between wheat and Elytrigia, between wheat and Agropyron, and between rice and sorghum; photosensitive genic male sterility in rice;

Taigu genic male sterility; inter-subspecies crossing between Indica and Japonica rice and apomicsis in rice. Some of those research results have been developed and used in production.

Crop Breeding and Elite Seed Multiplication and Extension

21. Since the middle of the 1950s, China has set up a national network for the regional testing of crop varieties, which is formed (i) at the national level and (ii) at the province, autonomous region and municipality level. This network is managed by the joint efforts of the national and provincial agricultural research institutions and the crop seed administration departments at corresponding levels. More than 900 regional variety test sites have been set up for over 20 crops and a properly organized regional test network has been formed. At the beginning of the Seventh Five-Year-Plan period, in order to strengthen the regional tests of major crop varieties, such tests were included in the national industrial test project, which emphasized the construction of 168 regional test sites for rice, wheat, maize, soybean and cotton.

22. At the same time, we have carried out extensive elite seed multiplication work. A policy of "four self with one supplement" was put forward in 1958, that is "self-selection, self-multiplication, self-preservation and self-use of seeds, supplemented with adjustment." This policy promoted the multiplication and distribution of elite seed under conditions of the times. After that, important reforms were conducted to strengthen China's elite seed multiplication, including the specialization of seed production, the mechanization of seed processing, the standardization of seed quality, the regionalization of variety distribution and the organization of a unified seed supply at the county level. As an aspect of elite seed multiplication, a series of measures were adopted to raise the multiplication coefficient and the seed production output, such as exploiting climatic differences among regions by conducting breeding in the north and multiplication in the south or breeding in the south and multiplication in the north and realizing multi-generation multiplication each year. More than 2,000 seed companies have been set up in the whole country and a developing industry with a certain economic strength has been formed. In recent years, the Government has also elaborated the "Seeds Administrative Regulations in the People's Republic of China" and the "Detailed Implementation Rules of Crop Seeds," which contain a series of regulations for crop seed promotion and utilization and permitted research and teaching institutions to manage seeds and coexist with seed companies. All these have played an important role in promoting elite seed multiplication, seed quality preservation and the rapid extension of elite seeds.

PROSPECTS FOR PLANT BREEDING AND EXTENSION IN CHINA

23. Crop germplasm resource studies should be reinforced. Although in recent years, considerable development and marked progress in crop germplasm resource studies in China have been made, we still have a long way to go in doing the research both intensively and extensively, compared with the developed countries and international agricultural research institutions. Therefore, as a basic task, crop germplasm resource studies must be reinforced in real earnest. Scientific and proper evaluation of the results of the crop germplasm resource studies should be based on its special characteristic in order to stabilize the size of professional teams. Collection and exchange of crop germplasm resources at home and abroad should be continued to provide good germplasm resources for the crop variety improvement so that new varieties and combinations of high yield, high quality and multiresistance can be bred.

24. Great efforts should be made in breeding new varieties of high yield, high quality and multiresistance. New crop varieties suitable for the middle and low-yielding areas should be bred, paying the same attention to this task as when breeding for the high-yielding areas. New crop varieties with resistances to drought, water logging, low temperature, saline-alkaline soils, wind, diseases and pests should be bred and developed to overcome the problems of natural disasters, low yields and other stresses. A remarkable feature of disease-and-pest-resistance breeding at the present time is the progress from single-resistance breeding to multiresistance breeding. The selection of crop germplasm resistance sources and the breeding of new high-yielding, high-quality and multiresistant crop varieties should be strengthened for the specific situation in China.

25. To further develop the market economy and improve the living standard of urban and rural people, quality breeding, including various kinds of famous, special and quality crop varieties should be bred and extended to meet the needs of the development of agriculture with high yield, high quality and high efficiency.

26. Real attention should be paid to basic research on crop breeding. Although significant progress in this respect has been made, considerable gaps still remain between China and the developed countries. Research on the relationship between the formation and development of important characters and environmental conditions, on the genetic control of disease and pest resistances, on adversity resistance and on other economic characters, and on the theory and the methods for the application of cytology and molecular genetics in plant breeding should be closely integrated with the tasks of plant breeding. Comprehensive planning, reasonable arrangement and definite division of labor should be carried out with joint effort by multi-sectors and multi-subjects so that significant breakthroughs can be made in plant breeding and the breeding research level improved continuously.

27. Vigorous action should be taken to enhance the protection of new plant varieties. The newly-bred plant varieties are the products of labor and intelligence by agricultural scientists. They should certainly be protected. On the basis of the existing regulations and measures, the process of the legislative work in the protection of intellectual property rights for plant varieties and seed production should be accelerated. The work of breeding new plant varieties and extension should be protected by the agricultural basic law so as to make new contributions to the realization of our country's transformation from self-sufficiency to a comparatively high standard of living.

REGULATIONS ON SEED MANAGEMENT AND THE CURRENT SITUATION OF THE PROTECTION OF NEW PLANT VARIETIES IN CHINA

1. The Chinese Government has always attached importance to the development of the seed industry and given support both through policies and funding. A scientific and technical system for seed including crop germplasm resources, genetics, breeding, regional trials, propagation, extension and marketing of good varieties and a network of technical services for good varieties and methods has been gradually set up. The issuance in 1989 of the Seed Management Regulations of the People's Republic of China put seed management into a legal framework. Meanwhile, the Chinese Government is reviewing its policies to estalish relevant laws on plant variety protection to safeguard the rights of plant breeders whose intellectual property rights are valued.

DEVELOPMENT OF SEED UNDERTAKINGS

2. As one of the most basic means of agricultural production, seed has always been given an important position by the government of every country. Since the founding of the People's Republic of China, great attention has been paid to variety improvement and seed production by the Chinese Government. As early as 1950, the Ministry of Agriculture drew up a Five-Year Plan of Good Variety Diffusion (Draft) and launched a mass movement of seed selection. In 1958, a guideline was established by the Ministry of Agriculture, underlining that seed production must be carried out by agricultural production cooperatives under the principle of self-breeding, self-selection, selfreserve and self-use supplemented by government redistribution (this is usually called the "four-selves and one-supplement"). It stipulated that the collective production units should reserve seed for their own field production and that, only when necessary, the redistribution of good varieties would be made by the Government. In November 1962, the Central Committee of the Communist Party of China and the State Council issued its Decision on the Enhancement of Seed Work, which required that agricultural research institutes undertaking plant breeding, demonstration farms for seed multiplication of good varieties, and seed stations (or seed companies) for good variety extension should be rectified and strengthened. A three-level breeding system was gradually formed in different areas, with good variety farms in each county as its core, good variety farms of communes or brigades as its bridges and seed production fields as its basis. This speeded up the diffusion of good varieties. In May 1978, the State Council issued its document No. 97 which approved and transmitted a Report on Enhancement of Seed Work Undertakings made by the Ministry of Agriculture and Forestry. The document required that seed companies and seed bases should be established and State farms should be reformed; that the extension system for the multiplication of seed of good varieties should be amplified; that the regionalization of variety distribution, the specialization of seed production, the mechanization of processing and the standardization of seed quality should be reached step by step; and that the supply of seed should be managed throughout by the counties in accordance with the "four-izations and one-supply" principle. On March 13, 1989, the State Council issued the Seed Management Regulations of the People's Republic of China. On June 24, 1991, the Ministry of Agriculture issued Detailed Implementation Rules to the Seed Management Regulations of the People's Republic of China on Agricultural Crop Seeds and other relevant supporting documents. Most of the provinces, autonomous regions and municipalities have issued their own seed management regulations or measures which provide seed management with

a legal framework and protect the legal rights of breeders, producers, sellers and users.

3. Starting from the middle 1950s, China has established a regional trials network of plant varieties at the State level and at provincial, autonomous region or municipality levels in which the daily work is supervised by the central or provincial agricultural research institutions or the seed management departments at their respective levels. In 1984, the central Government allocated special funds to construct the 168 regional experimental centers for rice, wheat, maize, cotton and soybean varieties. At the same time, the Government and the provincial governments set up their plant variety examination committees one after another, and drew up and released their plant variety examination regulations. From 1983 to 1987, 13 State criteria including the Food Crop Seed Inspection Rules and the Agricultural Crop Seed Inspection Rules were issued by the State Standard Bureau and seed quality supervision and inspection agencies were set up all over the country. From 1983 to 1991, with loans from the World Bank, 18 seed centers, 74 seed and nursery stock bases and 35 modernized seed processing assembly lines were constructed in 15 important agricultural production areas. The China National Seed Corporation, set up in 1978, has established trade relations and business contacts with seed corporations from more than 40 countries and regions all over the world. The technology transfer of the complete set of three lines for Indica hybrid rice seed production to American Western Oil Company and Australian Cargill Company in 1980 and 1981 respectively marked for China the time when its scientific results in seed improvement entered the field of international business.

SEED MANAGEMENT REGULATIONS

4. According to the Seed Management Regulations of the People's Republic of China issued by the State Council in 1989 and the Detailed Implementation Rules on Crop Seeds to the Seed Management Regulations of the People's Republic of China issued by the Ministry of Agriculture in 1991, the organization of seed management in China is currently as follows:

(i) Selecting and Breeding.- The selecting and breeding of new plant varieties are mainly carried out by agricultural scientific research, educational and production units at and above the prefecture and municipality levels, but the involvement of other collectives and individuals is also encouraged.

(ii) Regional Trials.- These are jointly organized by the central and provincial agricultural scientific research units and seed management departments. Regional adaptability trials for 2-3 years and field production trials for 1-2 years are conducted for each newly-bred good variety.

(iii) Variety Examination.- Variety examination committees at the State, provincial, autonomous region or municipality levels take charge of the examination of new varieties. The members of the examination committees are elected from administrative, seed management, scientific research and educational institutions. Those varieties that pass the examination will be awarded certificates and will be registered and made publicly available by the responsible agricultural departments at the corresponding levels.

(iv) Seed Production.- Specialized production is carried out mainly by the State-built seed production bases. Townships and individuals are also encouraged to produce seeds of good varieties for their own use. Seed produc-

tion units at different levels must hold a Seed Production License issued by the responsible departments of the People's Government at the county or higher level.

(v) Seed Marketing.- Conventional seeds are marketed through various channels. The main hybrid seeds are marketed by designated units. The Regulations on Producing and Marketing Crop Seeds and Animal Vaccines by Agricultural Scientific Research and Educational Units issued by the Ministry of Agriculture in 1992 permit agricultural scientific research and educational units to produce and market all kinds of good crop seeds (including conventional seeds, hybrid seeds and seed plantlets) either produced by themselves or imported from abroad after the seeds have been subjected to trials. Seed marketing units must hold a Seed Marketing License and a Business License prior to commencing operations.

(vi) Seed Inspection and Quarantine.- The relevant agencies of responsible departments at all levels and their designated units are in charge of seed quality inspection and quarantine for seed diseases and pests in accordance with relevant State regulations on seed inspection and plant quarantine.

ESTABLISHMENT OF SEED MANAGEMENT AGENCIES

5. According to the Seed Management Regulations of the People's Republic of China, the competent agricultural and forestry departments of the people's governments at different levels must take charge of the management of crop and forest seeds. The Agricultural Department of the Ministry of Agriculture takes charge of the management of national seed production. The following branches are set up under the Agricultural Department to carry out specific tasks:

(i) The Seed Division is in charge of drafting relevant regulations, plans and policies on seed and supervising seed management.

(ii) The National Seed Station is in charge of the implementation of seed technology programmes, of the extension and application of new technologies and methods of seed production, of the control and supervision of seed quality, and of seed processing and vocational training.

(iii) The National Plant Variety Examination Committee is in charge of examining new varieties.

(iv) The China National Seed Corporation is engaged in the international and domestic seed trade.

6. Seed stations and seed companies of the competent agricultural departments in the people's governments at provincial, prefecture (city) and county levels are in charge of seed-related matters for their own areas.

PROTECTION OF NEW VARIETIES

7. Until now, China has not had a set of special regulations on new plant varieties. According to Article 25, Section 6, of the Patent Law of the People's Republic of China, animal and plant varieties shall not be awarded patents, but the breeding methods of new animal and plant varieties are protectable by the Patent Law. It is said in Article 38 of the Detailed

Implementation Rules on Agricultural Crop Seeds of the Seed Management Regulations of the People's Republic of China of June 1991, established by the Ministry of Agriculture, that the transfer of new plant varieties (parents) and seed production technology against payment is allowed and that its implementation should be in accordance with the State laws on technology transfer.

8. Certain transfers of new plant varieties against payment have been made all over China in accordance with the relevant State policies. On the basis of learning from each other, complementing each other and sharing risks and profits, various forms of "breeding, propagation and extension (marketing) unions" have been jointly established by seed breeding units, seed companies and seed production farms, which effectively protect the interests of seed producers, sellers and users and promote the development of China's seed objectives. The three main activities of "breeding, propagation and extension (marketing) unions" are as follows:

(i) Breeding units transfer their good breeding technologies to seed companies against payment. They provide breeder's seeds and relevant technologies, and take charge of technical instruction in and supervision of seed production. Seed companies are in charge of the propagation, production management and extension (marketing) of new varieties.

(ii) Corporations or groups, which are jointly established by breeding units, propagation farms of good varieties and seed companies, provide services including variety trials, exhibition, propagation and the marketing of new varieties.

(iii) Breeding units and propagation units of good varieties are jointly responsible for seed management whereas breeding units are responsible for getting through the procedures necessary to obtain "the three licenses."

9. In order for China to bring its economy into the world trading system and to meet the statutes of a contracting party of the General Agreement on Tariffs and Trade (GATT), it is necessary for China to develop a new variety protection system which will be able to meet the requirement of the relevant international agreements on intellectual property right protection, to help to introduce good varieties from other countries in the world and to mobilize the initiative of our country's research and educational organizations, technicians, seed companies and individuals in breeding new varieties. The country's relevant departments are now establishing the special capability necessary to carry out investigation and research, and to draft relevant laws and regulations so as to establish a plant variety protection system suitable to the specific conditions of China, so as to safeguard the rights of the breeders.

THE CURRENT SITUATION OF THE PLANT BREEDING AND SEED INDUSTRIES IN BANGLADESH; THE POLICY ON THE PROTECTION OF NEW VARIETIES

1. Bangladesh was originally a part of British India. In 1947, British India, known as the Indian subcontinent, was partitioned into two independent States, India and Pakistan. Bangladesh became a part of Pakistan and was known as East Pakistan from 1947 to 1971. Later in 1971, East Pakistan became independent and sovereign again and named as Bangladesh. It is situated between 20°35' and 26°75' N latitudes and 88°75' and 92°40' E longitudes.

Plant Breeding in Bangladesh

2. During 1908, research in agriculture was institutionalized. In 1938, with the establishment of the Bengal Agricultural Institute (College) at Dhaka, agricultural education was initiated. During the early part of this century, research was confined mostly to rice, jute and sugarcane and as a result many improved crop varieties were developed. Up to 1950, sixty-three rice varieties were developed through mass, pure line selection and hybridization. But very few of those varieties were adopted by farmers. Due to lack of an efficient technology transfer mechanism, it was not possible to make those varieties popular among farmers.

3. Research on agriculture vis-à-vis plant breeding went through a series of organizational and structural changes during the 1950s and 60s. At present, only Government organizations are responsible for plant breeding. The Bangladesh Agricultural Research Institute (BARI, 1976) is a multi-crop research institute responsible for breeding all crops except rice, jute, sugarcane and tea; for these crops there exist respective specialized institutes, which are the Bangladesh Rice Research Institute (BRRI, 1970), the Bangladesh Jute Research Institute (BJRI, 1951), the Bangladesh Tea Research Institute (BTRI, 1952), the Sugarcane Research and Training Institute (SRTI, 1951). The Bangladesh Institute of Nuclear Agriculture (BINA, 1961), the Bangladesh Forest Research Institute (BFRI, 1955), the Institute of Post Graduate Studies in Agriculture (IPSA, 1983) and the Bangladesh Agricultural University (BAU, 1962) carry out research on plant breeding too. Of these Institutes, BAU, BFRI, IPSA, BINA and BARI are multi-crop research organizations and the rests are mono-crop institutes.

4. During the last two decades, these organizations developed and released 153 varieties of 33 crops (see Table 1). Since its inception in 1970, the Bangladesh Rice Research Institute developed 29 modern rice varieties now planted in 50% of the rice fields and contributing 70% of the food production in the country. The total area planted with rice, the major crop of Bangladesh, amounts to 10.5 million ha, 80% of the cultivated land.

5. There is no plant breeding activity in the private sector in Bangladesh. But a large amount of vegetable seeds and seeds of a few seasonal fruits are imported every year by the private sector. Vegetable seeds are imported without variety denominations. Bangladesh annually requires about 1,000 metric tons of vegetable seed. The public sector supply can cover only 5% of the total demand and the rest is filled by the private sector from internal sources and by import. A considerable proportion of vegetable seeds, now imported, could be produced in the country.

Table 1: Varieties of crops developed by different organizations and released by the National Seed Board (NSB), Bangladesh 1970-92.

	Number of varieties developed*								
Crops	BARI	BRRI	BJRI	SRTI	BTRI	BINA	BAU	IPSA	TOTAL
Rice	-	29	-	-	-	2	1	-	32
Wheat	16	-	-	-	-	-	-	-	16
Jute and mesta	-	-	8	-	-	1	-	-	9
Sugarcane	-	-	-	7	-	-	-	-	7
Potato and sweet potato	6	-	-	-	-	-	-	-	6
Maize and millets	6	-	-	-	-	-	-	-	6
Pulses	6	-	-	-	-	2	-	2	10
Oil seeds	14	-	-	-	-	2	4	-	20
Cotton	6	-	-	-	-	-	-	-	6
Vegetables	12	-	1	-	-	-	-	-	13
Spices	3	-	-	-	-	-	-	-	3
Fruits	2	-	-	-	-	-	-	-	2
Others	7	-	-	-	6	-	-	-	13
Total	78	29	9	7	6	7	5	2	143

* BARI = Bangladesh Agricultural Research Institute
BRRI = Bangladesh Rice Research Institute
BJRI = Bangladesh Jute Research Institute
SRTI = Sugarcane Research and Training Institute
BTRI = Bangladesh Tea Research Institute
BINA = Bangladesh Institute of Nuclear Agriculture
BAU = Bangladesh Agricultural University
IPSA = Institute of Post Graduate Studies in Agriculture

The Seed Industry in Bangladesh

6. To develop a seed program in Bangladesh, the Seed Ordinance of 1977 provided for the establishment of a National Seed Board (NSB) and a Seed Certification Agency (SCA), and the Seed Rules of 1980 specified the functions of the NSB and the SCA. The functions of the NSB are (i) to plan and co-ordinate the seed policy; (ii) to recommend seed certification and testing standards; (iii) to approve the release of new varieties; and (iv) to advise the Government on the import and export of seeds. The seed certifying agency is responsible for the quality control of seeds sold to farmers. At present, out of 33 crops released by the NSB, only three crops (rice, wheat and jute) are under a certification scheme and the other 30 crops are sold without any certification. Furthermore, out of the total requirement of seed of the said three crops, only 5% can be produced and certified by the SCA and

the rest is produced and marketed by farmers and private dealers without certification. In Bangladesh, quality seeds are classified into the three classes, such as breeder's, foundation and certified seed.

7. The Bangladesh Agricultural Development Corporation (BADC), established in 1961, is the only public sector agency for seed production and distribution in the country. The production and marketing of quality seeds by the BADC covers approximately 5% of the requirements in rice, 20% in wheat, 15% in jute, 8% in potato, and a negligible proportion in pulse, oil seed and vegetable crops. The BADC receives the breeder's seed from the research organizations and produces the foundation seed. The foundation seed is then sent to contract growers. The contract growers produce the certified seed which is purchased by the BADC at a high price. The certified seed is processed, stored and marketed to farmers by the BADC directly or through private dealers, at a subsidized, lower price. The major portion of the demand of seed by farmers is met, however, by private seed dealers, farmer-to-farmer exchange and with farmers' own seed. The quality of these categories of seed is not ensured.

8. It is found that a large amount of the seed requirement is met by the private sector. However, the quality of the seeds produced by the private sector is rather poor. Usually, they are small traders or farmers producing their own seeds. The private sector seed traders lack know-how of seed production and processing and storage facilities. Marketing channels are also poor. Private seed dealers purchase seeds from their contract farmers, store them and distribute them through their own sales centers or agents. Seeds are not processed and stored under appropriate conditions nor are they kept in sealed containers. The private sector seed industry in Bangladesh has the following constraints:

(i) lack of manpower trained in seed technology;

(ii) lack of facilities for seed processing, storage and marketing;

(iii) lack of financial incentives for big seed companies;

(iv) lack of information on the actual demand for seeds of different crops, a demand which fluctuates. There is a tendency for farmers to keep their old and poor quality seed stock. Awareness of the importance of replacing old stocks is lacking;

(v) unhealthy competition with the public sector, i.e. subsidy or sale of seeds by Government without a fixed price; and

(vi) in certain situations, lack of high-yielding and well-adapted varieties.

The Seed Policy of Bangladesh

9. The government of Bangladesh approved a Seed Policy in 1990. Main features of the Policy are:

(i) to train manpower in both the public and private sectors of the seed industry;

(ii) to encourage the private seed industry in the country and healthy competition between the private and public sectors involved in the seed industry;

(iii) to take, within the plant quarantine regulation, a liberal policy to encourage the import of superior crop germplasm from abroad;

(iv) to instruct the public sector seed industry to train manpower in the private sector and to make available their processing and storage facilities to private seed dealers;

(v) to promote the production of quality seeds and their distribution among farmers; and

(vi) to promote joint ventures between the public and private sectors.

10. According to the Seed Policy of 1990, seed certification is required only on a voluntary basis except for breeder's and foundation seed. Five crops (rice, wheat, sugarcane, jute and potato) were declared as notified/ controlled crops. Evaluation and release of varieties of the notified crops are regulated, while release procedures for the other crops are rather simplified. There are provisions for the mandatory registration of new varieties bred both by the public and private sectors. Release and registration of varieties are kept separate. The Seed Ordinance of 1977 and the Seed Rules of 1980 are being revised in the light of the Seed Policy of 1990.

The Policy on the Protection of New Varieties

11. As plant breeding does not exist in the private sector and the seed industry is just developing, there were no provisions on the protection of new varieties in the Seed Ordinance of 1977; neither was any provision included in the Seed Policy of 1990. However, there is a provision for the registration of varieties and protection of trademarks for the registered seed dealers.

THE CURRENT SITUATION OF THE PLANT BREEDING AND SEED INDUSTRIES IN INDIA; THE POLICY ON THE PROTECTION OF NEW VARIETIES

RESEARCH SET-UP

1. In India, the Indian Council of Agricultural Research (ICAR) is the apex body for coordinating research on agriculture, animal husbandry and allied aspects. For research related to crop improvement, the Council has an infrastructure of 15 research institutes, 9 national research centers, 32 coordinated crop improvement projects and 5 project directorates, besides the research programs in 26 State Agricultural Universities. These institutions have over 600 cooperating centers to cater for the research for the diverse requirements of different crops, commodities, regions, seasons, situations and systems.

VARIETAL DEVELOPMENT

2. Ever since crop improvement programs began in India during 1921-26 in a sketchy manner, the overall infrastructure has matured into a well-knit program of specific research projects and responsibilities for each center. The research achievements have contributed both to the advances in Indian agriculture, making India self-reliant in important crops, and in helping many developing countries where high-yielding cultivars developed in India are grown on a large scale.

3. India has the distinction of having developed hybrids in pearl millet, cotton, castorbean, grain sorghum and pigeonpea for the first time in the world. Due to concerted coordinated research efforts, over 2,000 varieties of different crops have been released and notified for commercial cultivation in the country. It is worth mentioning that Government of India's "notification" of variety is a prerequisite for undertaking certified seed production. About 99% of the notified varieties are contributions of the public sector. It is estimated that about 40% of the notified varieties are in commercial cultivation in different proportions. Along with the associated crop production technologies, the high-yielding cultivars can cater for the crop production requirements of the major portion of the diverse agroclimatic regions, seasons and situations in India.

4. Once taken to the farmers, a number of improved varieties have proved their worth and have enhanced productivity substantially. The genetic potential has often been shown to be almost four times higher than that of the national average yields. It is amply demonstrated that an enhanced yield of 20-25% could be realized just by replacing the obsolete varieties with the quality seed of improved varieties. The case of a few crops in pulses and oilseeds, where it is often said that not much has been done to improve production and productivity, is worth mentioning. In important pulse crops, namely chickpea, pigeonpea, mungbean, urdbean and field pea, gains to the tune of 70-80% have been observed in National Demonstrations conducted on farmers' fields by the use of improved varieties along with the associated production technology packages. Similarly, the potential of newly evolved hybrid oilseed varieties has been shown to be at least two to four times higher than the average national yields for various oilseed crops. Obviously, the seed production of suitable cultivars is of paramount significance to enhance production and productivity to meet the requirements of the increasing population in the country and also to export agricultural products to needy countries, so that the country gains in monetary terms as well.

SEED TECHNOLOGY RESEARCH AND SEED PRODUCTION

5. Initiated in a coordinated manner in 1979, seed technology research on an organised basis is conducted in 23 centers in different State Agricultural Universities with multidisciplinary teams involving 58 scientific, 84 technical as well as 31 administrative and supporting staff. The centers undertake research programs on aspects like seed production, processing, health and storage. In addition, a Central Seed Testing Laboratory has been established to discharge statutory functions and a Seed Section has been created at the ICAR Headquarters to deal with all aspects of seed research and breeder's seed production.

6. There are 38 breeder's seed production units for field crops and 11 for vegetable crops located in various State Agricultural Universities and ICAR institutes. Presently, there are 64 scientific and 85 technical positions in these institutions under the program. In addition, separate units for the production of breeder's seed of groundnut, sunflower and soybean have been established at 24 centers with 44 scientific, 101 technical as well as 16 administrative and supporting staff.

7. On the development side, there exist a National Seeds Corporation and a State Farms Corporation of India at the central level to organize and undertake foundation and certified seed production besides taking programs on breeder's seed production on a small scale. At the State level there are seed corporations in 13 States to organize foundation and certified seed production. Also, as the Government of India does not differentiate between the public and private sectors in the supply of breeder's seed, private seed companies are also involved in the production of foundation and certified seed of public-bred varieties in addition to seed production of their own varieties.

8. It is widely felt that the conversion of breeder's seed into foundation seed and subsequently into certified seed, which ultimately has to go to the farmer, is far from being satisfactory. Similarly, the fact remains that the distribution of certified seed to farmers is quite low as compared to the actual requirements for the gross area cropped in the country. The other important point is regarding the seed production of newly-evolved crop varieties. Even in the midst of a fairly appreciable pace of varietal development in the country through the large set-up of coordinated program centers, much is desired to bring timely awareness to development agencies and, consequently, to farmers about the potential of new varieties.

NEW POLICY ON SEED DEVELOPMENT

9. Since independence, Indian agriculture has witnessed spectacular advances in crop production and productivity as a result of the dedicated efforts of farmers, researchers and planners coupled with the necessary administrative and political support. Food grain production has risen from 50 million tons in 1950-1951 to a record 181 million tons during 1992-1993. Since 1951, the yields of wheat and potato have gone up by seven times, maize by four times, and rice, sugarcane, cotton and sorghum by three times. Nevertheless, despite these significant improvements, the country is far behind its projected requirements for the end of the current century. By 2000 A.D., the population is expected to grow to 1,000 million, and the food grain requirement would be around 225 million tons. The oilseed requirement would be around 26 million tons, which is easily attainable in view of the 20.6 million tons of production in 1992-1993.

10. Realising the growing needs, the Government of India announced the New Policy on Seed Development, which came into force on October 1, 1988. It aims at providing the Indian farmers with the best planting material available anywhere in the world so that productivity and, consequently, their income can be increased. Hitherto, seed production and distribution was mainly concentrated in the public-sector organisations, and the role of the private sector was limited. The new policy has encouraged seed production in the private sector so that an element of competition with the public sector is introduced and the farmer is able to have better access to quality seed available from anywhere in the world.

11. Earlier, the release and notification system of cultivars was only adopted by the public sector organizations, and there was no such system for the private sector, nor were they using the public-sector channels effectively for varietal evaluation. In the new policy, the private sector has shown keen interest in getting their materials evaluated, released and notified through the public channel. With only one season of testing at 15-20 locations, cultivars of foreign origin can be considered for provisional notification, thereby making them eligible for certified seed production in the interim period of 2 years of bulk import. After 2 years, the seed is envisaged to be produced indigenously and certification could be undertaken after regular notification based on the multilocation data available for two more years. Thus, the Government has taken an important step in augmenting the seed production activity and making it available to the farmers.

SEED VERSUS RIGHTS

12. Understandably, India is at a stage where the production and supply of quality seed of mostly publicly-bred varieties can provide a quantum jump in attaining higher production and productivity levels. However, to further augment the pace of gains in production, the private sector has been encouraged under the new policy. Besides making provisions to promote the private seed industry, there is also the question of desirability of effective support to the private sector if their effective role is to be ensured. At the present time, when the best planting material available in the world is aimed to augment productivity in crops, the expansion of research and development efforts in the private sector is imperative. It is obvious then that the private sector expects the necessary protection for their research efforts, or else a lack of incentives may dampen their initiatives. At the same time, India has to take a pragmatic view to ensure that such protection efforts, when given, would be in line with the interest of all farmers, the industry and the nation.

13. Unrestricted access to germplasm is considered essential so that uninterrupted improvements in crop plants can be brought about globally. As such, India has, all through, believed in the free flow of germplasm so that it can serve all mankind. Accordingly, India is a signatory to the FAO International Undertaking on Plant Genetic Resources of 1983 where the commitment to free flow of germplasm is reiterated. With the emergence of biotechnology as a powerful tool to overcome barriers to the crossing of species and to use any DNA fragment collected anywhere as a genetic resource which could be introduced into any plant material to improve its potential, pressure to agree to intellectual property rights in plants is mounting.

14. The institution of rights will also affect the fulfilment of the actual plant breeding needs of the country. India's priority for research is the development of varieties for difficult ecosystems. The country needs productive varieties for vast areas, where abiotic stresses of different kinds, namely drought, salinity, alkalinity, flood, frost, etc. limit productivity considerably. These are areas where farming is mostly done on small holdings by poor farmers with meager resources. The country also needs research efforts to combat the increasing problem of biotic stresses of different kinds. Some of the important areas for research in this direction are the incorporation of multiple genetic resistances in varieties, biological control of pests, the use of pesticides of plant origin and the economic and safe use of pesticides. To what extent would these needs be catered to by the private sector? Obviously, the Government has to rely on efforts by the public sector to give effect to these requirements, as the private sector would be mainly concentrating on profit-earning crops and situations. If rights are introduced, they are bound to make an impact on the strong public sector setup, which has, all through, been the basis for the prosperity of the nation as well as of the private sector in the country. Therefore, weakening of the public sector would certainly be against the interest of the nation as a whole.

DUS REQUIREMENTS AND VARIETY REGISTRATION

15. The International Union for the Protection of New Varieties of Plants (UPOV), an intergovernmental organization, has outlined certain basic requirements for the purpose of the introduction of the plant breeder's right. A system of DUS (distinctness, uniformity, stability) testing is imperative for the introduction of the plant breeder's right. These criteria allow varieties to be registered and legally protected. The coordinated system of testing in ICAR can be suitably modified to provide these basic requirements. However, there are certain specific issues with regard to each of these criteria. The distinctness of a variety is a requirement for any workable seed legislation, to ensure that the correct variety is being produced, certified and sold. With a successful history of seed legislation in India, the recognition of varieties for distinctness should cause no additional problems. Nevertheless, there are certain aspects of the requirement for distinctness that may lead to problems under plant breeder's right legislation. For example, the so-called "cosmetic breeding"--a slight modification of the characteristics of an existing variety, solely to meet the requirement of distinctness--can be of vital concern to private breeders. A typical case could be where a breeder changes a morphological, unimportant characteristic (perhaps governed by a single-gene) of a rival breeder's variety while leaving the other agronomically important characteristics intact. In fact, it has been argued that there is no clear-cut standard for minimum distances between varieties. However, analytical techniques are now available to allow any plant variety to be uniquely identified, thereby making it eligible for protection. With the introduction of a plant breeder's right legislation in India, publicly-bred varieties will have to be protected so that their misuse can be avoided.

16. The criteria of the uniformity and stability of characteristics on which the distinctness should be tested have been introduced to make the identification and recognition of the variety possible. However, varieties with low variation may be uniformly susceptible to diseases and pests with the risk of great loss in production.

17. A central agency for variety registration is considered essential irrespective of the PVP or PBR regime. This would ensure documentation of varieties with their important features at one place, and would take care of the misuse of material without acknowledgement. This would also provide much needed impetus to development of parental lines of hybrids which quite often go unrecognized, particularly in cases where these lines are not used in released and notified hybrids. This is essential as the non-recognition of developed parental lines works as a disincentive for this basic and crucial research activity for the development of commercial hybrids. In this endeavor, attention should be drawn to the following aspects:

(1) The establishment of a National Registration Agency similar to the National Institute of Agricultural Botany (NIAB) in the United Kingdom.

(2) The amendment of the Seeds Act of 1966 to make registration of varieties compulsory, without which the sale of seeds should not be permitted.

(3) The automatic release and notification of varieties.

GENE PATENTING AND BREEDERS' RIGHTS

18. In the Indian Patent Act of 1970, agriculture is considered basic to life, and, therefore, kept outside the purview of the Act. Further, in the Indian Act, only processes, but not products, are patentable, and the period of a patent is limited to 7 years.

19. Looking at the changes at the global level, whereby intellectual property protection is being extended to living forms, the Standing Policy Planning Committee of the Governing Body of ICAR constituted a Subgroup to examine the possibility of patenting genes and introducing plant breeders' rights for the continuous improvement of varieties and to ensure the availability of quality seeds to the Indian farmers to enhance their productivity and farm income. The advantages of and concerns about the implications of plant breeders' rights in the Indian context were deliberated in depth in a series of meetings of the Subgroup. It was realized that there is an urgent need to attend seriously to the problem of increasing food requirements to feed the increasing population. For this, all necessary measures to increase agricultural production and productivity need to be taken up.

20. Keeping in view the greater thrust required for hybrid research in the country, and likely investment by the private sector in hybrid development, and also the need for continuing research in this sector to supply a sufficient amount of hybrid seed of improved quality to farmers, it was felt desirable to consider granting plant breeders' rights in the case of hybrids. Hybrids, though rather being a product than a process, are recommended for the plant breeder's right as the product (hybrid) by itself is not able to regenerate as true to its prototype and hence would not be reused as such. Hence, this provision in no way would conflict with the existing policy on the subject of a process patent, adopted by the Government of India based on the Indian Patent Act (1970). The plant breeder's right should be applicable only to the hybrids and not to their parental lines, since secrecy of these materials would be maintained by the concerned organizations, and hence they would be responsible for their protection. However, a procedure for the registration of inbred lines of hybrids should be considered for which a system should be developed. The above recommendation was made in 1990 subject to the following conditions:

(1) Under the plant breeder's right scheme, the so-called research exemption must be maintained in order to use the protected material for research purposes.

(2) The protection period under the plant breeder's right scheme, which is usually 15 years or longer, would not be desirable as it restricts hybrid breeding programmes. Further, in general, the life span of hybrids is about seven years. Hence, for the rapid development of better hybrids and their diffusion on a time scale, the protection period should be restricted to seven years.

(3) For an effective research and development, a sound competition between the private and public sectors would be desirable. To ensure this, germplasm and potential material for hybrid development must continue to be made available to both sectors without any restrictions.

(4) Although not applicable in the case of hybrids, if in the future a plant breeder's right is granted to open-pollinated varieties as well, the use of harvested seed by farmers for their own cultivation should be permitted.

(5) A system of compulsory licensing should be introduced to ensure the production of seed and its supply to farmers in cases where a company having rights on a hybrid fails to undertake the production of seed corresponding to the requirements of the Indian farmer.

(6) Seed samples of parental lines will have to be kept in the National Gene Bank as reference samples so as to ascertain the genuineness of the material and to resolve disputes, if any.

(7) The DUS system for the evaluation of material is imperative. The coordinated testing system of the Council would provide this much needed requirement. If plant breeders' rights are agreed to, a suitable registration system and mechanism needs to be worked out by the Department of Agriculture of the Government of India.

(8) In any case, the responsibility for the exploitation of a plant breeder's right should be taken by the owner of the right (breeder/organization) and not by the Government of India. The owner of the right can, however, enforce his right by having recourse to the information generated and made available at the time of the registration of his variety as well as to reference samples deposited in the National repository.

The recommendations are being considered by the Government.

CURRENT THINKING

(1) It is believed that in the forthcoming years, both the public and private sectors will have to play a major role in the field of plant breeding and seed development in the country. Efforts are, therefore, required to encourage them to accelerate their research and development efforts. Obviously, policies and programs will have to be supplemented to ensure that both these sectors continue to play an important role in the development of agriculture in the country and thus serve farmers in an effective and efficient manner.

(2) India is likely to gain much if a plant breeder's right scheme is enacted. In the first instance, new techniques, technologies, means and material would flow to the country, and many jobs in the public sector could be done by the private sector, thereby saving limited public resources for diversion to the other priority research sectors, including basic and strategic research. Secondly, under reciprocal rights, Indian varieties, which were hitherto freely available to all, could bring considerable monetary returns to the country. However, to harness the vast available well-trained manpower and get the most from the fairly well developed public sector infrastructure and the diversified agro-climatic conditions, a structural adjustment would be imperative.

(3) Irrespective of the intellectual property regime, the registration of varieties and parental lines must receive urgent attention. Accordingly, the development of an appropriate system should be given priority. Further, for the germplasm resources of the country, utmost attention should be paid to their collection, conservation, evaluation and utilization. Since it must be considered as a resource, the commercial value of each material must be analyzed. Under the current circumstances, the sovereign right of the nation should be appropriately protected.

(4) It is widely felt that naturally occurring genes are not a patentable subject. Further, the intellectual property regime should work in such a way that the free flow of material for further research should not be restricted and farmers should conserve their right to use a part of harvested grains for the next year's sowing.

THE CURRENT SITUATION OF THE PLANT BREEDING AND SEED INDUSTRIES IN INDONESIA; THE POLICY ON THE PROTECTION OF NEW VARIETIES

INTRODUCTION

1. The seed industry is crucial to agricultural development. Seed was perhaps the most important form in which the technology of the green revolution was transferred to farmers. As the new biotechnology moves from the laboratory to the field and seeds incorporate functions such as the ability to resist pests and generate nutrients that were previously supplied by other industries, the seed industry may become even more important.

2. The seed industry can be considered to consist of all enterprises that produce or distribute seeds.

3. The seed industry involves, at least, the following activities:

(1) Plant breeding research, the purpose of which is to improve plant varieties through the introduction of exotic varieties, pure line selection, and hybridization. Plant breeders produce the breeder's seed of new varieties.

(2) Seed production and multiplication where seed enterprises produce, by using the breeder's seed, the commercial seed which is to be distributed to farmers.

(3) Processing and storage. Processing involves drying, cleaning, treating with chemicals, packaging seeds and assuring the quality of seed.

(4) Marketing and distribution. Marketing involves promoting the seed produced by the enterprise, and distribution means the physical and logistical exercise of making the seed available at the right place and at the right time.

4. The overall performance of the seed industry is measured by sales, profits, or growth and depends on the efficiency of all these components. Plant breeding research, a basic input of the seed production process, is itself the result of basic research and development.

5. The structure of the seed industry in developing countries is, as far as the organizational form is concerned, a mixture of public research institutions, public sector seed corporations, private local firms, farmers' associations, multinational companies and non-governmental development agencies.

THE CURRENT SITUATION IN INDONESIA

6. Indonesia is now finishing its first long term 25 years economic development plan. The Guidelines of State Policy-1988 have determined that the objective of Repelita V is twofold, namely:

(1) to increase the standard of living of the entire population; and

(2) to build a strong foundation for the next development stage.

7. In Repelita V (1989/1990 - 1993/1994), the target for the annual economic growth rate is 5%, with 3.0% in the agricultural and 8.5% in the industrial sector. Although its growth rate is only 3.6% annually, agriculture is strategic and given the first priority in economic development because it is the source of income of most Indonesian people.

8. The national development priorities in Indonesia in the field of agriculture are:

- increase of agricultural production
- increase of product quality and food diversification
- export expansion
- protection of the environment
- regional development
- human resources development
- private sector development

9. It is obvious that plant production in any country will benefit very much from well-developed plant breeding and reproduction research efforts and the related industry within the country. Plant breeding is a powerful tool for shaping, directing and optimizing agriculture. This field of research integrates and develops knowledge from a number of basic sciences and aims at the creation of genotypes which are more suitable for growers, trade, the processing industry, consumers and the environment.

10. It is a broad, complex and multidisciplinary field of research with a very favorable cost/benefit ratio, and producing an ecologically safe result. Breeders face many different problems in a large number of crops. Their task is so extensive that it must be approached from different angles and, as funds are restricted, effective cooperation between potential partners is necessary.

11. Indonesia has given a high priority to the development of biotechnology. The State Minister for Research and Technology has established a National Biotechnology Center in Bogor to coordinate research and development for agricultural biotechnology.

12. The application of biotechnology in agriculture is primarily the responsibility of the Agency for Agriculture Research and Development (AARD). Plant breeding and plant protection research are carried out by all institutes of the AARD.

13. Biotechnology research on food crops, including molecular and cellular biology, is performed at the Central Research Institute for Food Crops (CRIFC) in Bogor. At the Central Research Institute for Horticulture (CRIH), biotechnology research on horticultural crops is done at its local research institutes in Lembang and Solok. Tissue culture technology is one of the subjects most studied by these research institutes.

14. Concerning the organization of research activities in the AARD, two comments can be made:

- The capacity of research on horticultural crops is relatively low;
- The number of scientific research staff with higher levels of education is relatively low.

15. In general it can be stated that the present capacity and level of plant breeding and reproduction research does not adequately reflect the crucial importance of this field of research for further development of priority crops and the solution of priority problems.

16. Further, the state of development of private industries in plant breeding and reproduction in Indonesia has still to be improved. For many commodities, private enterprises are poorly developed.

THE INDONESIAN POLICY ON THE PROTECTION OF NEW PLANT VARIETIES

17. The Republic of Indonesia has enacted a new regulation on plant cultivation in 1992, which regulation can be briefly described as follows:

(1) The quality of seed, as a basic material for plant production, should be maintained, in order to get such productivity and quality as are required.

(2) For that reason, it is necessary to organize activities including the collection of germplasm and plant breeding and any other activities which would lead to the finding of high-yielding varieties. In order to stimulate those activities, the Government will give recognition to the discoverer of a new variety and give him the right to put his name on the discovered variety.

(3) Such recognition can be given also to the owner of a superior plant. If hiqh-yielding varieties cannot be found in Indonesia for certain kinds of plants, for the time being, the Government can introduce them from abroad.

(4) In order to guarantee that new varieties resulting from plant breeding and introduction from abroad have good quality, they have to be tested before their release. If the result of that test is good and fulfills the prescribed requirements, the Government will release and distribute those varieties.

(5) The released varieties should be controlled and their production and distribution should be organized.

(6) A seed certification system is an effective supporting mechanism to guarantee the quality and the organization of the production and distribution.

(7) Seed certification can be implemented by the Government and the private sector. Certified (labeled) seeds are those seeds of which the quality (genetic, physiological and physical) is guaranteed.

(8) A newly bred variety cannot be distributed and multiplied unless the Government has already authorized its release.

REFERENCES

(1) "A Framework for Seed Policy Analysis," by Carl E. Pray and Bharat Ramaswami, International Food Policy Research Institute

(2) Joint feasibility study in the further enhancement of plant breeding research in Indonesia, by the Indonesian Ministry of Agriculture and the Netherlands Ministry of Agriculture, Nature Management and Fisheries.

(3) Undang-undang Republik Indonesia Nomor 12 tahun 1992 tentang Sistem Budi Daya Tanaman (The Indonesian Regulation of Plant Cultivation System No. 12/1992), by the Ministry of Agriculture, Republic of Indonesia.

THE BREEDING AND SEED PRODUCTION OF PADI AND FRUIT CROPS IN MALAYSIA

INTRODUCTION

1. Malaysia covers a total area of 33.06 million ha of which 14.75 million ha are estimated to be suitable for agriculture (Joseph, 1990). The sector is dominated by plantation crops. Oil palm is the major crop with over 2.0 million ha, followed by rubber with 1.8 million ha and cocoa with about 400,000 ha. Padi is the main food crop with 650,000 ha and 191,895 ha under fruit (Malaysia Agricultural Dir. & Index 93/94). A host of miscellaneous crops like pepper, vegetables, flowers, tobacco, maize and tapioca are also grown on a smaller scale.

2. Agriculture still holds an important position in the Malaysian economy, contributing 16.32% to the GDP in 1992 (Asean Newsletter, June 1993). In recent years, the sector has experienced slower growth due to increasing emphasis on industrialization which has partly contributed to a labor shortage.

3. Among staple food crops, the area under padi has shown a slow and steady decline since 1975. Of the national area, about 70% is in Peninsular Malaysia, 8% in Sabah and 22% in Sarawak (Malaysia Agricultural Dir. & Index 1993/1994). The main padi growing areas of peninsular Malaysia are as per Table 1. With the current increase in population, the demand for rice will continue to increase from 1.55 million m. tons in 1990 to 1.9 million m. tons in the year 2000.

Table 1: Main padi growing areas of peninsular Malaysia ('000 ha)

Area	1984	1988	1989	1990
Muda	158.7	188.3	189.5	189.7
Krian/Sg Manil	48.8	59.9	40.3	51.1
Komubu	26.2	38.8	29.8	45.9
Barat Laut	35.2	35.4	34.9	26.5
Seberang Peral	20.8	20.2	21.9	21.8
Seberang Peral	4.1	10.9	16.0	17.1
Besut	4.2	6.1	8.3	8.0
Kemasin Semarak	-	5.8	13.9	13.9
TOTAL	298.0	365.4	354.6	374.0

Source: Malaysia Agric. Dir. & Index 93/94

4. The Malaysian fruit industry has made significant progress in the last decade and is expected to increase further by the year 2000. The area under fruit in Malaysia has risen from 128,558 ha in 1985 to 191,895 ha in 1990 and is projected to increase to 331,786 ha in the year 2000 (Malaysia Agricultural Dir. & Index 1993/1994). At governmental policy level, the fruit industry has been given the necessary impetus with the formulation of the National Development Plan and the National Agricultural Policy. These policies encourage the active development of the fruit industry to supplement farm income, generate growth and reduce poverty, providing adequate incentives and allocation of land for large scale production of selected fruits for fresh domestic consumption, processing and export.

5. Malaysia produces a wide range of tropical fruits which can be divided into two groups. The seasonal fruits comprising mango, durian, jackfruit, rambutan, mangosteen and citrus and non seasonal fruits, i.e. bananas, papaya, pineapple, guava, watermelon and starfruit.

6. The domestic per capita consumption of Malaysian fruits has risen from 19.0 kg in 1988 to 27.74 kg in 1991 and is expected to increase by 6.0 to 7.5% annually (Mukhtiar, S. 1993). The trend in exports is very encouraging with an increase from $76.5 million in 1987 to $153 million in 1991 and an annual average growth rate of 13.45%. The fruit industry is mainly a smallholder enterprise comprising holdings of 1-2 hectares in size and widely scattered. In instances where only fruits are grown, an array of different fruit types is usually cultivated. The disorganised and highly fragmented distribution of uneconomic sized fruit units and the diversity of fruit types makes systematic marketing problematic. With the increase in demand in domestic and potential foreign markets and the opportunities available in downstream activities such as fruit processing, there is a pressing need for the development of the fruit industry, especially amongst the larger producers. The challenge is to ensure a continuous and adequate supply of quality fruits produced locally at competitive prices. With the current emphasis on fruits, about 24 commercial fruit orchards were developed in 1991 with an average holding size of about 260 ha.

BREEDING PROGRAMS

7. Plant breeding activities, especially for food and horticultural crops, are being undertaken by Government agencies such as the Malaysian Agricultural Research and Development Institute (MARDI). Apart from MARDI, new varieties are also developed by local universities and to some extent by the private sector. The Department of Agriculture (DOA) was also involved in the development of fruit varieties/clones before MARDI was formed in 1970.

Padi

8. The rice variety improvement program is an ongoing program which receives high priority from MARDI. The program emphasizes the importance of regional selections rather than the centralized development of varieties. While the program originally envisaged the development of stable rice varieties adapted to a broad range of environments, there has been a change to meet the requirements of specific agro-ecological conditions in the country. The use of genetic resources for breeding purposes has also been encouraged.

9. The breeding objectives encompass:

(i) The improvement of crop yield potential with the emphasis on breaking the currently observed yield plateau of 5-6 t/ha.

(ii) The incorporation of multiple resistances to major diseases and pests i.e. blast, bacterial blight, sheath blight, tungro and brown plant hopper.

(iii) The improvement of grain quality with emphasis on grain length and the characteristics of cooked rice such as tenderness, glossiness and aroma.

(iv) Development of short-maturation varieties which will help keep the season in phase in double-cropping areas.

Achievements

(i) In the development of varieties with a short maturation period, two varieties have been released in 1991, namely MR 123 and MR 127 which have a maturation period of 114-120 days and 120-128 days, respectively, compared to the existing varieties with a maturation period of 130-150 days. The characteristics of the released MARDI varieties are as per the appendix to this report.

(ii) Four varieties of high-quality rice have been identified, i.e. Basmati Q4, Basmati Q6, Mutant Mahsuri and Jarum Mas. However, all four have lodging problems. One potential line has been isolated from each of Mutant Mahsuri and Jarum Mas. These are being bred further for quality.

(iii) All of the recent varieties released by MARDI were resistant to blast. Most of them were moderately resistant to moderately susceptible to bacterial blight and brown plant hopper, while almost all varieties were highly susceptible to Tungro.

(iv) Hybrid varieties produced from the IR 58025A, IR 62829A and RU 2340A parentage have been found to give yields of 14-20% higher than MR 84. These varieties were produced using the cytoplasmic male-sterility method.

Fruit Crops

10. The Department of Agriculture (DOA) is the national registrar for new fruit varieties. New fruit varieties from the private sector, or other semi-governmental agencies are identified, selected and registered as new varieties. Up to the year 1992 the number of fruit varieties registered is as per Table 2.

11. Recently, fruit research has been given top priority in MARDI. Collaborative research is emphasized within both the Institute and other agencies. The major thrust areas for production research are:

(i) The development of superior varieties, both for fresh consumption and processing.

(ii) The development of efficient production technology.

(iii) The development of technology for effective weed, pest and disease control.

(iv) The development of pest disinfestation technology for export fruits.
(v) The development of postharvest technology.
(vi) The exploitation of the less important fruit types.
(vii) The development of technology packages for commercial fruit production.

Table 2: Number of fruit varieties registered by DOA

Fruit Types	Scientific Names	Number of Varieties Registered
Cempedak/ Donkong	Artocarpus champeden	36
Duku Langsat	Lansium domesticum	5
Durian	Durio zibethinus	193
Guava	Psidium guajava	15
Jackfruit	Artocarpus heterophyllus	31
Mango	Mangifera indica	226
Mangosteen	Garcinia mangostana	1
Orange/ Tangerine	Citrus suhuiensis	66
Pomelo	Citrus maxima	65
Rambutan	Nephelium lappaceum	193
Sapodilla	Achras sapota	63
Starfruit	Averrhoa carambola	19

Achievement

12. Some fruit varieties developed and released by MARDI after decades of breeding and selection are as per Table 3.

Table 3: Fruit varieties released by MARDI

Fruit Types	Year Released	Varieties	Parentage
Durian	1991	MDUR 78, MDUR 79 MDUR 88	D 10 x D 24
Papaya	1984	Eksotika (Line 20)	Subang x Hawaiian Solo
	1991	Eksotika II	Line 20 x Line 19
Pineapple	1985	Hybrid 1	Singapore Spanish x Smooth Cayenne

13. In addition to the above, further varieties/clones registered by DOA on the basis of their good fruit quality, yield and resistance to diseases were recommended for commercial planting. Recommended clones of some popular fruit types are as per Table 4.

Table 4: Fruit varieties selected and recommended by DOA

Fruit types	Varieties
Durian	D 24, D 99, D 123, D 145, D 158, D 159, D 169
Mango	MA 128, MA 162, MA 165, MA 204, MA 223
Rambutan	R 134, R 156, R 160, R 162 R 167, R 168, R 170, R 185 R 191
Starfruit	B 2, B 10, B 17

SEED PRODUCTION

Padi

14. The Department of Agriculture (DOA) is the major supplier of certified rice seed for the farmers. Foundation seeds of released varieties are made available by MARDI. DOA produces registered seeds in its Commodity Development Station in Teluk Chengai, Kedah and Talang Perak. The certified seeds are produced in the five Commodity Development Stations or on farmer's land under the seed growers' scheme on a contract basis.

15. The increasing adoption of the direct seeding method of padi production as a means of saving cost and overcoming labor shortages coupled with the preference of the farmers for high quality seeds has resulted in an increased demand for certified rice seeds. At the inception of the seed production program under the seed project in 1984, most farmers were using the 'transplanting' method of padi cultivation; the production target then was 2300 m. ton/year. Currently, the production target has increased to 5260 m. ton/year. However, the amount produced is not enough to meet the present demand.

16. It is envisaged that the number of farmers adopting the direct seeding method will increase. This will increase the seed demand fourfold. The seeding rate for direct seeding is about 100kg/ha compared to 'transplanting' which is about 25kg/ha.

Fruit Crops

17. Based upon the projected figure for the area to be cultivated with fruit by the year 2000, a total of about 8000 ha of fruit orchard will have to be developed every year. Planting material must be prepared to meet the demand from the projected area, which is at least about 1.2 million plants (based on the average of 150 plants/ha). This figure will only cover the areas to be newly planted, and does not cover the amount necessary for the replanting and replacement of existing stands.

18. The production of fruit crop planting material is presently carried out by both the public (Government agency, university, research institution) and private sectors. The Department of Agriculture, being the main producer, produced about 515,000 units of planting materials in 1992, and about 470,000 plants were produced by 142 private nurseries in 1989.

SEED QUALITY CONTROL

19. Due to the absence of a Seed Act in the country, seed quality control is done via a certification scheme which is on a voluntary basis. Meanwhile Malaysian Standard (MS) Specifications for padi and fruit planting material have been developed as a means of aiding the industry to strive for qualified planting material.

Padi

20. The certified and registered seeds produced by DOA and the stock or foundation seeds produced by MARDI are required to meet the Malaysian Standard (MS). Each agency undertakes its own quality control on the seeds produced. In order to meet the minimum field standards set, DOA has implemented the Seed Certification Scheme in which field inspection for varietal purity is carried out on all the seed production areas. Laboratory tests to determine the minimum seed quality standards are carried out in the form of germination and purity tests. The different categories of seed must conform to the minimum field standard and minimum seed standard as given in the MS and per Table 5 and Table 6.

Table 5: Minimum field standard

Factor	Maximum permitted (%)			
	Breeders' Seed	Foundation Seed	Registered Seed	Certified Seed
(a) Off-types	None	0.05	0.10	0.30
(b) Seeds of noxious weeds*	None	0.05	0.10	0.20
(c) Plants affected by seed-borne diseases**	None	0.05	0.20	0.50

* Echinochloa Beauv., Scirpus grossus L., Leptochloa chinensis, Ischaemum rugosum, Oryza rufipogon

** Brownspot (Preschlora oryzae), bacterial leaf blight (Xanthomonas oryzae), bacterial leaf streak (Xanthomonas oryzicola), Bakanae (Gibberella fujikuroi) and blast (Pyricularia oryzae)

Table 6: Minimum seed standard

Factor	Maximum permitted (%)			
	Breeders' Seed	Foundation Seed	Registered Seed	Certified Seed
(1) Purity				
(a) pure seed (min.)	99.00	98.00	98.00	98.00
(b) inert matter (max.)	1.00	2.00	2.00	2.00
(c) other crop seed (max.)	None	None	0.05	0.10
(d) noxious weed seed (max.)	0	0	5 grains/kg	10 grains/kg
(2) Germination (min.)	80.00	80.00	80.00	80.00
(3) Moisture content (max.)	14.00	14.00	14.00	14.00

Fruit Crops

21. The certification program which is still at the initial phase of implementation has yet to be introduced for governmental agencies and private companies. However, product specifications and the Malaysian Standard for fruit crop planting material have been developed to ensure the authenticity and quality of planting material for the public. The Malaysian standard specification for planting material for Durian and Mango are as per Table 7.

Table 7a: Malaysian standard specification for durian planting material

	Bud-grafted	Wedge-grafted
Minimum scion height (cm)	30	30
Minimum age (months after grafting)	4	4
Complete leaves (number)	8	8
Maximum months after grafting	8	11
Stem diameter at 10 cm above the union (cm)	0.5	0.5

Table 7b: Malaysian standard specification for mango planting material

	Bud-grafted
Minimum scion height (cm)	25
Minimum age (months after grafting)	4
Minimum number of whorls	2
Maximum months after grafting	12
Minimum stem diameter at 10 cm above the union (cm)	1.0

CONCLUSION

22. The seed industry in Malaysia is still in its infancy and at the stage where the majority of the research programs and seed production functions are carried out by Government agencies with minimal involvement of the private companies. The seed certification program for padi seeds is confined to the production areas under the supervision of DOA. As for fruit planting material, it is still at the initial stage of implementation and only on a voluntary basis.

23. To date, there is no Seed Act nor law for the protection of new plant varieties in Malaysia.

REFERENCES

WAHAB, A.H., ALIAS, I., AZLAN, S., MOHD KHALID, M.Z., and OTHMAN, O., 1986: "Persidangan Padi Kehangsaan"; MARDI

Anon.: "Penyelidikan Buah-buabau, 1992"; MARDI

Anon., 1991: "Laporan Tahunan"; MARDI

Anon., 1993: "Malaysia Agricultural Directory and Index 93/94"; Pantai Maju Son. Bhd.

Anon., 1993: "Senarai Klou Buah-buahan Yang Didaftarkan"; Jabatan Pertanian

Anon., 1991: "Technical Review of MARDI Rice Research Plan"; MARDI

Anon., 1993: "Country Profile - Malaysia"; Asean Newsletter (June Edition)

DEANNA, S., 1991: "Towards Formulating a Policy on the Padi Seed Production Program of The Department of Agriculture Malaysia"; DOA

JOSEPH, K.T., 1990: "Sustaining Agricultural Land in Malaysia, Prospect, Policy and Problems." Proceeding PAUPM Seminar on Sixth Malaysian Plan Agricultural Policy and Strategies, Kuala Lumpur, Malaysia

MASDEK, N.H., CHONG, S.T., and SHAHADAN, M., 1991: "Commercial Production of Planting Materials"; MARDI

MUKHTIAR, S., 1992: "The fruit Industry in Malaysia, Market Potential and Marketing Aspects"; FAMA

MOHD. YUSOF, H., MOHD. HASHIM, M.N., 1985: "Malaysian Agriculture - Crop Options." Seminar on Malaysian Agriculture - What Next; A.I.M.

OTHMAN, O., AHMAD ANWAR, I., 1984: "Rice Production in the Year 2000 - Likely Trends in Technology." Conference on Asean Agriculture in the Year 2000; A.I.M.

CHARACTERISTICS OF THE RELEASED PADI VARIETIES

Variety	Parentage	Maturation (Days)	Plant Height (cm)	Panicle N./Hill	Panicle Length (cm)	1000 Grain Weight (g)	Yield ton/ha	Year Released	Eating* Quality
Malinja	Siam 29/Pebifum	137-147	110-120	12-16	26	26,5	2,5-4.0	1964	A
Mahsuri	Taichu 65/2 Mayang Ebos 80	134-138	120-130	12-16	26	16.6	3.0-4.5	1965	G
Ria	Peta/Dee-Geo-Woo-Gen	125-127	91-97	13-16	24	27.7	4.5-5.6	1966	P
Bahagia	Peta/Tangkai Rotan	137-145	110-125	13-15	27	24.4	3.5-5.0	1968	A
Murni	Bahagia/Ria	135-140	85-100	12-16	24	24.5	4.0-5.6	1972	A
Masria**	IR8/Muey Nahng 62M	123-126	85-91	11-14	23	24.6	3.0-4.4	1972	G
Jaya	Peta/BPI-76	123-127	93-100	12-16	26	23.5	3.5-5.0	1973	G
Sri Malaysia I	Peta/Tangkai Rotan	135-145	100-115	16-18	25	23.4	4.5-5.5	1974	P
Sri Malaysia II	Ria/Pankhari 203	128-130	95-100	12-15	26	29.2	3.9-5.0	1974	P
Pulut Malaysia I**	Pulut Sutera/Ria	135-145	95-100	13-15	25	21.5	3.9-5.0	1974	G
Setanjung	IR22/Pazudofusu	135-143	110-120	15-17	24	27.1	4.1-6.3	1979	P
Sekencang	Jaya 3/Tadukan	120-125	97-120	13-14	24	24.4	3.1-5.0	1979	G
Sekembang	IR8//Engkatek/Sacupak/// RIA 163	140-146	95-109	14-16	23	21.1	3.2-5.8	1979	A
Kadaria	IR8//Engkatek/Sacupak 4/// TRM 6	125-132	95-117	16-20	22	18.2	2.9-5.0	1981	A
Pulut Siding	Pulut Sutera/Ria 2//Tjina	135-143	115-125	13-15	26	26.3	2.7-4.7	1981	G
Manik	Radia Goi/Ria 4//Tadukan	140-145	110-115	12-15	25	23.8	4.0-5.0	1984	G
Muda	RU 243/BRJ 51-26-11	126-132	110-115	12-15	26	25.8	5.0-5.5	1984	A
Seberang	67009/Zenith/IR4215-4-3-1	133-135	110-115	13-15	24	21.8	5.0-5.5	1984	G
Makmur	MR 1 2/Pongsu Seribu 2	130-140	102-112	12-14	25	24.1	4.5-5.5	1985	G
MR 84	CR 261-7039-236/MR 50	132-137	97-105	13-17	23	26.0	4.0-6.2	1986	A
MR 81	MR 24 2/IR 36	124-140	99-107	12-17	23	20.5	4.2-6.0	1988	G
MR 103	RU 1217-432/RU 1378-24-4	125-140	105-110	13-15	25	25.5	4.6-6.3	1990	A
MR 106	MR 71/IR 21912-131	132-136	93-98	15-18	23	21.0	4.5-7.1	1990	A
P.H.9***	Pulut Hitam Siam/MR 33	114-120	88-102	13-15	23	22.3	3.8-4.7	1990	G
MR 123	Y 776/Y 680	114-120	88-95	13-15	24	26.5	4.8-6.1	1991	G
MR 127	MR 1/MR 7/MR 71	120-128	101-110	10-13	25	25.3	4.7-6.0	1991	A

*A-Acceptable
G-Good
P-Poor

**-Glutinous variety

***-Black glutinous variety

THE CURRENT SITUATION OF THE PLANT BREEDING AND SEED INDUSTRIES IN PAKISTAN; THE POLICY ON THE PROTECTION OF NEW VARIETIES

INTRODUCTION

1. Pakistan appeared on the world map just 46 years ago on August 14, 1947. It came into being through a political division of the Subcontinent of India. The territory comprises many diversified regions. The mountains are to the north and west. The arid and semi-arid areas are in the south. The fertile plains are in the centre. The northern high mountains are bestowed with beautiful valleys, eternal glaciers and snow-covered peaks, including the second highest mountain of the world, the K2. The central plain, called the Indus plain, is irrigated by the Indus and its tributaries. The Indus plain has the largest canal irrigation system in the world. It makes cultivation possible despite scanty and erratic rainfall and extreme ranges of temperature.

2. Pakistan is situated between latitudes 24° and 37° N. The climate is characterized by extreme variation of temperature and rainfall. The average annual rainfall varies from about nil to over 1,000 mm. Most of the central and southern areas have less than 500 mm annual rainfall.

Climate and Agro-ecological Zones

3. The distribution of the cropped area is further influenced by the agro-ecological conditions prevailing in Pakistan. The country has been categorized into the following 10 distinct agro-ecological zones:

ZONE 1 Comprises the Indus delta with an arid tropical marine climate and clayey and silty soils. The mean maximum temperature in summer ranges from 34 to 40°C and in winter from 19 to 20°C. The mean monthly rainfall during summer (July to September) is about 75 mm, while in winter (December to February) it is less than 5 mm.

ZONE 2 Includes the Lower Indus Basin with a subtropical climate and silty and sandy loam soils. The mean monthly temperature in summer rises up to 50°C in the shade. The summer rainfall is about 16.2 mm.

ZONE 3 The region includes the Thal and Cholistan deserts and is characterized by a summer maximum temperature rising to 41°C. The monthly rainfall during the summer season varies from 32 to 71 mm.

ZONE 4 The region covers the area between the Sutlej and Jhelum rivers. The soil is sandy loam and clayey loam. The mean monthly rainfall in summer ranges from 75 to 108 mm.

ZONE 5 The salt range of the Pothwar Plateau and the Himalayan Piedmont Plains form this region. Climate is nearly humid to semiarid and hot.

ZONE 6 This includes mountain ranges with tops covered by snow during the winter and spring seasons. The mean monthly rainfall in summer is 236 mm and in winter 116 mm.

ZONE 7 This comprises high mountain areas with undifferentiated climate and clayey soils. The tops of the mountains are generally covered with snow for the greater part of the year.

ZONE 8 This lies to the south of Safed Koh and west of the Indus with an undifferentiated climate and loamy strongly calcareous soils.

ZONE 9 This zone comprises mountainous areas with intermountain basins, plateaus and the coastal belt. It has an arid (desert type) tropical climate and strongly calcareous silty loam soils.

ZONE 10 This covers the Piedmont Plains of the Sulaiman Ranges, sloping towards the Indus river.

Land Use

4. The following are the latest statistics on land use in Pakistan.

Table 1

	Land use	Million hectares
1.	Geographical area	79.61
2.	Cultivated area	21.11
3.	Culturable waste	8.76
4.	Forest	3.44
5.	Total irrigated area	16.96

Source: Agricultural Statistics of Pakistan 1991-92.

Population

5. Pakistan today is the world's tenth most populous nation. The count at present estimates over 115 million people. The population is estimated to be about 145 million by the turn of the century. The annual growth rate is about 3.1%.

6. The population is predominantly rural. About three-quarters of the population lives in 49,000 farm villages ranging in size from small clusters of homes to large villages and market towns.

Farm Size

7. The number and area of private farms, classified by farm size is as follows:

Table 2: Farm classification

	Farm size		Number (Mill.)	(%)	Area (Mill. ha.)
1.	Small farms	(up to 5 ha)	4.11	81	7.44
2.	Medium farms	(5-10 ha)	0.62	12	4.12
3.	Big farms	(10 and above)	0.34	7	7.64

Source: Agricultural Statistics of Pakistan 1991-92

Cropping Pattern

8. There are two main crop growing seasons in Pakistan, i.e. Kharif (Summer) and Rabi (Winter). 55% of the area is covered by food grain cereal crops, including wheat, barley, rice, maize, sorghum and millets. 18% comes under cash crops like cotton, sugarcane, tobacco and sugar beet. 7% is covered by pulses, 2% by oilseeds, 1% by vegetables, 2% by fruits and 15% by miscellaneous crops.

Table 3: Area under major crops

Crop	'000 ha
Wheat	7,877.6
Rice	2,096.9
Maize	847.5
Cotton	2,835.5
Pulses	1,420.4
Sugarcane	896.1
Oilseeds	511.0
Vegetables	215.0
Condiments	166.0
Fruits	463.8
Others	3,113.0

Source: Agricultural Statistics of Pakistan 1991-92

Agricultural Production

9. Agricultural production is dominated by crop production, which accounts for almost 69% of agriculture's GDP. The rest is accounted for by livestock, which is almost 30%. Forestry and fisheries currently make up just over 1% of the total.

10. There are four major crops, namely wheat, cotton, rice and sugarcane. The fifth most important crop is maize, but its production is very low compared to its potential as a 'Kharif' crop. Among minor crops, the most important are fruits and vegetables followed by pulses and oilseeds. These crops are important because they are high-value crops and have great potential for export earnings (fruits & vegetables) and import substitution (oilseeds and pulses).

Table 4: Area, production and yield of important crops in 1990-91

Crop	Area '000 ha	Production '000 t	Yield kg/h
Wheat	7,877.6	15,684.2	1,990
Rice	2,096.9	3,243.1	1546
Cotton	2,835.5	12,822.2 (bales)	769
Sugarcane	896.1	3,8864.9	4,3400
Maize	847.5	1,203.1	1419

Source: Agricultural Statistics of Pakistan 1991-92

PLANT BREEDING IN PAKISTAN

11. Extensive plant breeding and research programs are under way in the country at three Agricultural Universities, 13 Multidisciplinary and 31 Mono-commodity Research Institutes established in different agro-ecological zones. These research institutes are responsible for developing superior cultivars through genetic manipulation. They also address other problems affecting agricultural production and cover all economic crops and related disciplines. Each of these institutes has the mandate to develop better adapted varieties for local agro-ecological conditions.

12. The majority of the research institutes are sponsored by the respective provincial government. The program of work and some projects are coordinated and partly funded by the Pakistan Agricultural Research Council (PARC) at the federal level. Plant germplasm is the raw material required by the breeders for developing new, superior crop varieties that ensure stable production. The collection, preservation, evaluation and maintenance of germplasm is carried out by the Plant Genetic Resources Institute, PARC (for cotton by PCCC). This material is then made available to plant breeders.

SEED PRODUCTION AND QUALITY CONTROL

Background

13. Prior to 1961, the Department of Agriculture was responsible for making arrangements for the production, quality control and distribution of seeds of major crops. But the seed situation remained deficient regarding the production and the supply of pure seeds.

14. On the recommendation of the Food and Agriculture Commission, the West Pakistan Agricultural Corporation (WPADC) was created in 1961. In addition to other developmental activities its functions included seed multiplication, testing and distribution. It continued until 1972, when it was dissolved and seed quality control was taken over by the Federal Government, while seed production and distribution shifted to the provincial governments.

15. The seed situation demanded major improvements, so the Government of Pakistan invited the World Bank to appraise a seed program for the country, and on their recommendation a Seed Industry Project was launched in the country. To provide legal regulation and control of the quality of seeds, the Seed Act of 1976 was promulgated.

16. This enactment provided a regulatory mechanism for controlling and regulating the quality of seed through the setting-up of the necessary institutional infrastructure which included the National Seed Council (NSC), Provincial Seed Councils (PSCs), the National Seed Registration Department (NSRD) and the Federal Seed Certification Department (FSCD). The establishment of the National Seed Council with the Federal Minister for Food and Agriculture as its chairman, having full authority for policy formulation and for setting up and regulating the production and quality of seed, initiated a new era of seed development in the country. This supreme institution represents all disciplines concerned with the development of the seed industry both in the private and public sectors. Both the NSRD and FSCD are the executive arms of the NSC. The Provincial Seed Councils are responsible for arranging the production and distribution of certified seed to the farming community, and as a result the Punjab Seed Corporation (three processing plants) and the Sindh Seed Corporation (one processing plant) have been established.

Induction of the Private Sector

17. In addition to the public sector seed corporations, the privatization promotion policy of the Government of Pakistan has encouraged the emergence of some multinational seed companies like:

- Pioneer Pakistan Seeds Ltd. Lahore,
- Cargill Pakistan Seed (PVT) Ltd. Lahore,
- Sandoz (Pakistan) Ltd. Lahore,
- Lever Brothers Pakistan Ltd. Karachi,
- ICI, Pakistan Ltd. Karachi.

These companies are specifically introducing hybrid varieties of sunflower, maize, millets and sorghum.

Variety Evaluation

18. The crop breeders test and evaluate a large number of strains in small-scale variety trials at the research centers and promising materials are further tested in Zonal Variety Trials (ZVT) outside the research centers. The breeders are aware of the variation that can occur on account of the genotype-environment interaction. In order to overcome these phenomena the Zonal Variety Trials are conducted widely in the areas of adaptability, usually in cooperation with enlightened growers and on Government farms. When a breeder selects a variety and considers it to have sufficient merit, he submits seed samples to the National Seed Registration Department to assess the distinctness, uniformity and stability criteria for the purpose of describing and registering that variety.

19. **Distinctness (Uniqueness, Novelty).-** A variety is distinct if, at the time of registration, it is clearly distinguishable from other existing registered and commercial varieties of the same crop by one or more morphological, physiological, cytological or other characteristics.

20. **Uniformity (Homogeneity).-** A variety is considered sufficiently uniform if the individual plants in a population are similar and genetically identical in morphological characteristics. The degree of uniformity depends upon the mode of reproduction of the variety in question.

21. **Stability.-** A variety is considered stable if, after successive multiplications, it retains its distinguishing and essential characteristics.

22. The registration of varieties provides the basis for:

- the seed quality control through the Federal Seed Certification Department,
- the administration of the plant breeder's right,
- the maintenance of breeder's nucleus stocks of the variety true-to-type for the production of pre-basic seed.

23. Simultaneously, the seed samples are provided to the Variety Evaluation Committees of the Pakistan Agriculture Research Council (PARC) for crops other than cotton. For cotton, seed samples are submitted to the Pakistan Central Cotton Committee. Both these organizations evaluate the candidate varieties in the light of the value for cultivation and use (VCU) criteria.

Table 5: Number of varieties registered during 1981-92

Crop	Sindh	Baluch	Punjab	NWFP	PARC	PVT	Total
Wheat	6	2	26	6	-	-	40
Rice	6	-	6	5	-	-	17
Maize/Millet	-	-	6	8	-	2	16
Cotton	8	-	25	-	-	-	33
Oilseeds	3	-	6	6	6	5	26
Chickpea	1	-	5	2	-	-	8
Mung/Lent	-	-	8	1	-	-	9
Vegetables	1	3	12	-	-	-	16
Sugarcane	-	-	2	6	-	-	8
Fodder	-	-	10	-	-	1	11
Others	1	-	2	1	-	-	4
Total	26	5	108	35	6	8	188

Value for Cultivation and Use / Agronomic Value

24. Agronomic value or value for cultivation and use is the most important and only criteria for which commercial varieties are developed. Only those crop varieties are eligible for registration and release which are superior to existing commercial varieties in one or more characteristics.

25. A variety that meets the requirements of VCU and DUS is then accepted for registration and release as defined in the Seed Act of 1976, which provides that a "released variety" means a registered variety having agricultural value for growing and approved by the National and a Provincial Seed Council.

Seed Classes and Quality Control

26. According to the Seed Act of 1976, the following four classes of seed are recognized for production, procurement, processing, storage and marketing:

(1) pre-basic seed or breeder's seed: this is the elite material in respect of genetic purity;

(2) basic seed or foundation seed: this is the progeny of pre-basic seed;

(3) certified seed: this is the progeny of basic seed;

(4) approved seed: this is the progeny of certified seed produced in quarantined and isolated areas under the seed producing agencies.

27. Quality control through crop inspection and seed testing is provided by the Federal Seed Certification Department. The quality of all the classes of seed has to conform to the standards prescribed by the Government. The quantities of seed certified and marketed during 1990-91 are given in Table 6.

Table 6: Quantities of seed certified during 1990-91

Crop	Quantity ('000 mt)
Cotton	28.44
Wheat	43.19
Rice	2.07
Maize	0.43

Seed Processing, Marketing and Promotion

28. Commercial scale seed production, processing, storage, marketing and other operations are undertaken by the public sector seed corporations established in Punjab and Sindh. The establishment of similar seed corporations in other provinces (NWFP and Baluchistan) is underway.

29. Four seed processing plants (3 in Punjab and 1 in Sindh), with an annual capacity of 103,000 mt, have been installed for wheat, cotton, rice and maize. The quality seed is distributed and marketed through their own networks, cooperatives and private sector sales agents. Another two seed processing plants in the private sector have been established in Punjab (Pioneer and Cargill).

30. The Provincial Seed Corporations have their own seed promotion services provided to contracted growers through Farm Advisory Services. The outreach programs of the Pakistan Agricultural Research Council (PARC), the Extension Departments of provincial governments and the electronic media help promote quality seed.

Seed Imports

31. Since the country is not self-sufficient in meeting the seed demands for all crops, a considerable quantity of seed of various crops is imported every year (see Table 7).

Table 7: Seed imports during 1990/91

Crop	Value ('000 Rupees)
Seed potatoes	5,177
Onion	647
Tomato	6,293
Oilseeds	17,337
Vegetables	68,495
Forage	197,410

Source: Foreign Trade vol. 18, June 1991, Fed. Bur. of Stat.

Maintenance Breeding

32. The maintenance of a variety is a cyclically repeated activity during the lifetime of the variety. Therefore, an efficient seed renewal system is essential for a successful seed program which is not possible unless the variety is properly maintained. It is the responsibility of the originating institution to maintain and make available, through a continuous seed renewal system, pre-basic seed for later multiplications of basic and certified seed classes.

The Plant Breeder's Right

33. As mentioned earlier, Pakistan has vital agricultural research and plant breeding programs which entirely fall under the public sector. Therefore, there was no strong demand for the introduction of a plant variety protection system. But the involvement of private companies in the seed industry will lead to a demand to introduce a plant breeder's right system in Pakistan. This demand now receives full backing from public sector breeders, too.

34. A draft of the Plant Variety Protection Act is under active consideration by the Government of Pakistan. The draft was prepared by the National Seed Registration Department in consultation with UPOV, the Asian Development Bank and other international centers. The draft was sent to all provincial governments and circulated among all public and private sector research institutions and seed agencies. The major question now before us is how to accommodate public sector breeders in the system.

THE CURRENT SITUATION OF THE PLANT BREEDING AND SEED INDUSTRIES IN THE PHILIPPINES; THE POLICY ON THE PROTECTION OF NEW VARIETIES

INTRODUCTION

1. The plant breeding activities of both, the public and private sectors in the Philippines have spawned a relatively vibrant seed industry over the last 10 years. This is very apparent from the establishment of research, production, processing and marketing facilities by local and foreign seed companies. High acceptance of new varieties by farmers coupled with direct and indirect assistance by the Department of Agriculture for crop production enhancement programs could bring better prospects for the sustained growth of the seed industry in the country.

2. There is, however, an emerging clamor among those involved in research and development efforts in the private sector to institutionalize plant variety protection in the Philippines in order to protect them against unfair competition and infringements of their products. This will certainly encourage more investment in research and development of new and better crop varieties, which will ultimately benefit the farmers.

3. This paper briefly discusses the current situation of the plant breeding and seed industries and the prospects for plant variety protection in the Philippines.

RESEARCH CENTERS FOR CROP IMPROVEMENT IN THE PHILIPPINES

4. For the most important crops, Government institutions basically lead crop improvement research in the country. These research centers are usually commodity or discipline-based and are agencies attached to State colleges and universities (SCU's) or agencies of the Department of Agriculture (DA). Examples of agencies of the Department of Agriculture (DA) are the Philippine Rice Research Institute, the Philippine Coconut Authority, the Cotton Research and Development Institute, etc. The Bureau of Plant Industry (under the DA), aside from its regulatory role for the seed industry, is also doing plant breeding work on selected crops. Examples of SCU-based research agencies are the Institute of Plant Breeding (University of the Philippines at Los Baños), the Philippine Root Crop Research and Training Center (Visayas State College of Agriculture), and the University of Southern Mindanao Agricultural Research Center.

5. Most of the private groups engaged in crop improvement usually started with the distribution of local and imported seeds. Gradually, they conducted serious breeding work on selected crops such as vegetables, ornamental crops and cereals. Lately, big foreign seed companies entered the local scene. Their main product is hybrid corn, which incidentally is the second most important crop next to rice. It is safe to say that the bulk of the plant breeding research money spent by all of the private seed companies is devoted to hybrid corn research.

SEED PRODUCTION AND DISTRIBUTION

6. Compared to other countries, the Philippine seed production and distribution system is still poorly developed. Difficulties facing the seed industry point to inefficient production and distribution, low acceptance of recommended seeds (partly due to poor extension), and lack of effective legislation (Baluyot, 1991, Mabesa and Sevilla, 1980). It is estimated that certified seeds constitute less than 10% of the total amount of seed available on the market (Roperos, 1990).

7. One of the recognized obstacles to the rapid adoption of new plant varieties is the lack of effective seed production and distribution. This is specifically acute among the public research institutions with weak extension activities and lack of manpower and facilities to produce and distribute the seeds in the target areas. However, this is not much of a problem for the private seed companies that have invested in seed research, production/processing plants, and marketing networks. In fact, the relatively rapid growth of the seed industry for the past 10 years is largely due to the efforts of these private companies.

8. It is often said that the private seed growers are the missing link in the adoption of new and better varieties. Except for rice and corn, there are hardly any organized seed growers in the Philippines. Most of the seed growers of Government-bred varieties, particularly for rice and corn, are either members of cooperatives or individual farmer entrepreneurs. Many of them, however, are highly dependent on national programs for their market, i.e., they are active only if the Government procures certified seeds for its production programs. More often than not, these seed growers cease operations with the end of the production program.

9. The recent launching of the Grain Production Enhancement Program (GPEP) of the Department of Agriculture as part of the pump-priming activities of the Government is considered a shot in the arm for the rice and corn seed industries. One of the major components of the GPEP (which will run from 1993 to 1998) is the use of certified seeds for increased production of the two most important cereal crops. The Government will source seeds from both public and private seed producers for the five-year program and hopefully will encourage the farmers to use certified seeds of superior varieties and consequently help sustain the growth of this seed sector.

SEED INDUSTRY DEVELOPMENT ACT

10. An important piece of legislation known as the Seed Development Act of 1992 (Republic Act No. 7308) has recognized the importance of the promotion and acceleration of the seed industry in the Philippines. Among the salient provisions of the Seed Act is the promotion of the seed industry as a preferred area for investment and the encouragement of the private sector to engage in seed research and development. To attain these objectives, a National Seed Industry Council (NSIC) was created to formulate policies and programs for the development of plant breeding activities and the seed industry in the country. The NSIC actually replaces the Philippine Seed Board which used to administer variety accreditation and seed quality control. Recently included in the implementing rules and regulations of the Council is the establishment of variety registration for various crops approved for release in the country.

POLICIES ON THE PROTECTION OF NEW VARIETIES

11. The first known patent law in the Philippines was the Spanish Law on Intellectual Property of January 10, 1879. This law was replaced by the United States Copyright Law from 1898 until 1924, when the Philippine Legislature enacted Act No. 3134 or "An act to protect intellectual property," which was patterned after the American Copyright Law of 1909. On June 20, 1947, the Philippine Patent Office was established (presently known as Bureau of Patents, Trademarks, and Technology Transfer) under Republic Act 165 which was patterned mainly on the United States Patent Law.

12. Unfortunately, there is no provision in the present Patent Law and jurisprudence stipulating that plant varieties are patentable. Section 7 of Republic Act 165 indicates that patentable subject matter includes machines, manufactured products or substances, processes, or improvements of any of the foregoing (Sapalo, 1992). There is also no provision in the Seed Industry Development Act of 1992 that implicitly relates to the protection of new plant varieties, although the National Seed Industry Council is given the mandate to formulate policies for the promotion of plant breeding activities. It is therefore clear that as of the present, living entities such as plant varieties are not recognized as patentable and a separate law should be enacted by the Philippine Congress in order to address the need for the protection of new plant varieties.

13. The need for plant variety protection in the Philippines has generated discussions among the concerned sectors. It has been discussed informally among plant breeders. It has also been raised in formal forums conducted by the Department of Agriculture. In one of the DA's management committee meetings in 1993, one of the representatives of the private seed companies suggested the enactment of a law that will protect their varieties from unfair competition. The Secretary of Agriculture was said to be supportive of the idea (Lantin, personal communication). Also, the National Committee on Plant Genetic Resources, through the Philippine Council for Agriculture, Forestry, and Natural Resource Research and Development (PCARRD), the coordinating agency for agricultural research in the country, will sponsor a symposium/workshop in November 1993, the main objective of which will be to formulate a national policy on proprietary rights, varietal registration and exchange of the country's plant genetic resources.

SUMMARY

14. Plant breeding activities for the most important crops in the Philippines have long been dominated by Government institutions. The adoption of new varieties and the use of certified seeds, however, have rather been slow due to the inefficient seed production and distribution system. The initiatives of the private sector (either as developers of new varieties or as producers/distributors of Government-bred varieties) coupled with strong support by the Government are regarded as the keys to the development of the seed industry. This has been convincingly demonstrated in the case of the hybrid corn seed industry, where the private sector is now leading in research and development activities. This increasing involvement of the private groups in seed research, production and distribution has definitely spurred the development of the seed industry by creating new varieties and markets for its products.

15. The idea of enacting a law on plant variety protection has been gaining adherents, especially from the private groups engaged in seed research and development. At present, the Patent Law or Seed Industry Development Act does not provide for the patenting of new plant varieties. However, the need to encourage investment in seed business has triggered formal and informal discussions on this issue. It seems that our policy makers are starting to realize the importance of formulating policies on plant variety protection as part of the efforts to attract new investments in the seed business. After all, a strong and dynamic seed industry will ultimately benefit the farmers and greatly enhance the development of Philippine agriculture.

THE CURRENT SITUATION OF THE PLANT BREEDING AND SEED INDUSTRIES IN THE REPUBLIC OF KOREA

1. It is my great pleasure to have the opportunity of attending this seminar and reporting on the current status of the plant breeding and seed industries in the Republic of Korea. First of all, I would like to thank UPOV which has devoted itself to developing an effective international plant variety protection system for the advancement of the plant breeding and seed industries and for the improvement of agricultural productivity worldwide. I would also like to extend my sincere gratitude to those who have organized and sponsored this Seminar. This occasion will surely help us understand more deeply the spirit and working system of UPOV and we will take this opportunity to consider our own plant variety protection systems suitable for our respective national situations.

2. I will start my report with a brief introduction to the regulatory aspects of the seeds and seedlings issues in my country. The Republic of Korea is a country having a dense population and a very limited area of arable land. Thus, it has developed a labor- and capital-intensive agricultural production system. The major crops are rice, barley, legumes, tuber crops such as potato and sweet potato, and vegetables such as radish, cabbage and hot pepper. The increase in income over recent years as a result of economic development has shifted the attitude of consumers on agricultural commodities from quantity to quality. Therefore, the necessity to adjust the crop production system to meet the consumers' needs and preferences is much emphasized and strenuous efforts are directed to enhance the competitive position of locally produced commodities against foreign products under an open market situation.

3. There are two laws regulating plant varieties, seeds and seedlings in the Republic of Korea, namely the Major Crops' Seeds Law and the Seeds and Seedlings Control Law. The Major Crops' Seeds Law provides the basis for Government control of breeding, seed production and distribution for 23 major field crops including rice, barley, wheat, rye, oats, corn, beans, potato, sweet potato, peanut, sesame, rapeseed, millet, perilla, etc. For crops controlled under this law, breeding and seed multiplication are undertaken mainly by Government organizations. On the other hand, the Seeds and Seedlings Control Law regulates the performance of varieties and the quality of seeds and seedlings of vegetables, fruit trees and mushrooms of which the breeding and/or seed production are predominantly done by commercial firms. At present, the commodities under the control of this law are 14 vegetable, 6 fruit and 8 mushroom species. The purpose of the above laws is to increase agricultural productivity and to support farmers through Government intervention in the plant breeding and seed industries, and not to introduce a plant breeder's right system. The Patent Law of the Republic of Korea provides that asexually propagated plants can be protected under the general patent regulation. However, the number of such patents, so far granted under this system, is too small to satisfy the general interests of breeders.

4. I will endeavor to explain a bit more the organization of the crop breeding and seed industries as well as the extension services in relation to cultivar improvement and seed selection. Crop improvement is carried out by various government organizations, especially research institutions under the Rural Development Administration (RDA), agricultural universities and private seed companies. Public organizations concentrate on the breeding of major cereals such as rice, barley and soybean, whereas private seed companies are

mostly involved in the breeding of commercial vegetable crops. 171 major cereal varieties are currently designated as recommended or semi-recommended cultivars, while about 1,600 vegetable varieties are listed by the Ministry of Agriculture, Forestry and Fisheries (MAFF). With recent developments in cropping technology, hybrid vegetable seeds with a higher performance are preferred for their improved quality and productivity, though they may be more expensive than traditional non-hybrid varieties.

5. The seeds of major cereals such as rice, barley and soybean are multiplied by Government organizations under strict quality control through the following steps: pre-basic seeds by the Provincial Rural Development Administration (PRDA), basic seeds by the Basic Seed Production Office (BSPO) under provincial governments, and certified seeds by the National Office of Seed Production and Distribution (NOSPD). On the other hand, 45 private seed companies are responsible for the production of vegetable seeds and quality control during seed multiplication. Seeds of major cereals and vegetables are distributed through different channels. Certified cereal seeds processed by the NOSPD are distributed to farmers through provincial governments and agricultural cooperatives, while vegetable seeds multiplied or imported by private seed companies are sold in the open market. In both cases, farmers are free to take their own decisions on the choice and purchase of seeds. Through Government channels, 8,245 mt of certified seed of rice were distributed to farmers in 1992. Private seed companies marketed 2,968 thousand liters of vegetable seeds, of which 517 thousand liters, worth some 10 million US$, were exported in the same year. Systematic supports for farmers in choosing cultivars and seed are given. The RDA extension specialists stationed in every major rural township provide information on cultivars and seeds, and assist farmers in cropping. The RDA regularly publishes informative material for farmers. Private seed companies also provide information on their products to farmers' groups.

6. Most importantly, I would like to mention the present situation of the questions of plant variety protection and seed industry development. According to the present laws, cereal cultivars released through Government channels should be designated as recommended varieties by MAFF and vegetable cultivars bred by private companies need to be registered with MAFF. This provides a partial protection against unauthorized multiplication and commercialization of recommended or registered cultivars by third parties. However, it is far from the exclusive protection by plant breeders' rights provided for by the UPOV system. As I mentioned before, our crop improvement programs focus on superior cultivars of high quality, stress resistant and adaptable to mechanization to meet the consumers' needs and to maintain the competitive position of Korean agricultural products in global markets. We are now trying to stimulate the breeding efforts, and to improve the seed production and quality control of specialized seed companies. We are also examining the possibility of participation by the private sector in the breeding and seed production of the major cereals. The introduction of the UPOV system is under serious consideration in relation to the future amendments of the aforementioned laws.

7. I would, consequently, like to take advantage of this opportunity to kindly request a continued cooperation with UPOV, its member States and non-member States in Asia and the Pacific region. Finally, I do hope that UPOV and the international harmonization of plant variety protection systems will prosper and contribute to the worldwide development in agriculture and the welfare of farmers.

Thank you very much for your attention.

THE STATUS OF THE SEED INDUSTRY IN THAILAND

1. As presented and discussed at the UPOV Seminar held in Tsukuba, Japan, in 1991, the private sector has only recently taken part in the plant breeding program and the seed industry of Thailand. In the past plant breeding was solely a mandate of the Government, and seed production and distribution was done by Government institutions.

2. At present, both the Government and the private sectors play an important role in the improvement of new varieties and in the seed industry. However, private companies, whose business is based on a profit-making basis, are only interested in high value crops such as hybrid maize, flowers and vegetables. The Government, on the other hand, which is a non-profit organization, develops, produces and distributes such major crops as rice, maize, sorghum, soybean, mungbean, peanut, etc. It is rarely the case that a private company is prepared to run its business on a marginal low return basis.

3. The major Government institution responsible for plant breeding is the Department of Agriculture (DOA). The Department is responsible for the Rice Research Institute, the Field Crops Research Institute and the Horticulture Research Institute which are responsible for breeding rice, field crops and horticultural crops, respectively. Universities, including the School of Agriculture, also take part in plant breeding. However, they usually concentrate on field crops such as maize, soybean, mungbean and peanut.

4. The system of seed production in Thailand is a three-step system: the production of (i) breeder's seed, (ii) foundation seed and (iii) extension seed; registered seed and certified seed are included in extension seed. The production of breeder's seed and foundation seed of the approved varieties is carried out and supervised by the breeders. If the varieties are bred by the Government, it is carried out by the Department of Agriculture of the Ministry of Agriculture and Cooperatives. Universities are responsible for the production and supervision of breeder's seed and foundation seed of their own varieties. In the private sector, the research section of each company is responsible.

5. The Department of Agricultural Extension (DOAE) is responsible for the production of extension seed from foundation seed which is derived from the Department of Agriculture and universities. In the private sector, the production sector produces extension seed. In the governmental sector, the extension seed may, in some cases, be produced by the Marketing Organization for Farmers (MOF) and agricultural cooperatives. The extension seed is sold to the farmers and the grain produced from extension seed is theoretically not recommended to be used as seed. For more detail, please refer to the proceedings of the Regional Seminar on the Nature of and Rationale for the Protection of Plant Varieties under the UPOV Convention held in Tsukuba, Japan, in 1991 (UPOV publication No. 717(E), pp.135-140).

6. The current Government seed production capacity is shown in Table 1. This indicates that the production capacity of the Government is far from meeting the demand. This is due to the increasing awareness of the farmers of the importance of high-quality seeds.

Table 1: Planted area, total extension seed required and extension seed produced by Government institutions, Thailand, 1991

Crops	Planted area (1,000 ha)	Foundation seed (tons)	Extension seed required (tons)	Extension seed produced (tons)	Shortfall (%)
Rice	10,152	532	634,500	20,240	96.81
Wheat	8	40	1,000	88	91.20
Maize	1,746	96	32,744	2,650	91.91
Sorghum	194	10	3,037	1,500	50.61
Soybean	489	275	30,588	4,630	84.56
Mungbean	470	87	14,682	1,860	87.33
Peanut	124	150	11,538	1,990	82.75
Cotton	74	17	4,662	195	95.82
Sesame	58	3	724	93	87.15
Kenaf	128	15	2,398	188	92.16
Vegetables	314	5.5	3,931	64	98.37

Sources: Department of Agriculture and Department of Agricultural Extension

Remarks: The amount of foundation seed and extension seed produced by the private sector is not available.

Policy on the Protection of New Varieties

7. During the last few years there had been a number of discussions by plant breeders from public and private organizations about the advantages and disadvantages of having plant breeders' rights in Thailand. It was reported that opinions in general, though not conclusive, seemed to favor the farmers' interests in the sense that if plant breeders' rights were adopted, farmers might have to pay a premium price for plant varieties.

8. Thailand has the Patent Act B.E. 2522 (1979). Under this Act, plant and animal varieties are not eligible for protection. A part of Section 9 of Chapter 2 of the Act states that a patent shall not be granted to any variety of animal or plant or any essentially biological process for the production of animals or plants.

9. Nevertheless, an effort to indirectly protect new plant varieties in order to guard against piracy has been put forward.

10. The Department of Agriculture has classified plant varieties into four categories and has defined each category as follows:

(i) **Common, ordinary or landrace variety.**- A general variety being in use and not having been registered, certified or recommended.

(ii) **Registered variety.**- A variety that has been registered in accordance with the Department of Agriculture's regulations. The regulations require that botanical characteristics of the variety be officially recorded for future use.

(iii) **Certified variety.-** A variety that has been certified in accordance with the Department of Agriculture's regulations as a good variety; its botanical and agricultural characteristics must be the same as those submitted for certification.

(iv) **Recommended variety.-** A certified variety that has been approved and recommended by a committee appointed by the Minister for Agriculture and Cooperatives to be used as an officially recommended variety in the Government programs and for general use by farmers.

11. In 1992, the Seed Act of 2518 B.E. (1975) was amended. The key issues of the amendment were (i) to define a plant variety and planting material, (ii) to add a section for registered, certified and recommended varieties and (iii) to add a section for conserved plant species under the CITES Convention. Under this amended Act the Ministry of Agriculture and Cooperatives has drafted a notification entitled "Approval of Registered Varieties and Certified Varieties of Plants in Accordance with the Seed Act." The Department of Agriculture is the official implementing institution. The criteria for applications for the registration and certification of varieties as stated in the Notification are as stated below.

Registered Variety

12. An application for registration in respect of a variety can be made to the Department of Agriculture. The submitted variety must meet one of the following specifications:

(i) be a variety derived from a breeding program through either hybridization or induced mutation. The variety may be a pure line, open-pollinated, synthetic, composite or hybrid variety;

(ii) be a variety derived from the reselection of indigenous or introduced varieties with botanical and improved agricultural characteristics such that a new cultivar is obtained;

(iii) be a variety introduced directly from abroad without improvement.

Certified Variety

13. A variety submitted for certification must be a registered variety approved by the Department of Agriculture. Furthermore, the variety must be prominent in yield and quality and should be economically important.

Steps of Approval for Registration or Certification

14.1 The submitted variety and its characteristics (and agronomic quality, for a certified variety) are reviewed and recorded by a committee from the Department of Agriculture.

14.2 Registration or certification is approved by the Committee for Variety Registration and Certification.

14.3 Notification of evidence is posted in public for 90 days.

14.4 The Director-General of the Department of Agriculture issues a certificate of registration or certification if there is no protest or claim within 90 days.

14.5 The Director-General shall not issue a certificate if there is a claim or protest within 90 days, or if the characteristics of the variety do not correspond to the information submitted, or if the characteristics of the submitted variety are similar to or the same as those of a variety that the Department previously approved.

14.6 The Department reserves a right to cancel the approval if later there is evidence that the variety in question is similar to another variety which has been approved, or if there is proof that the characteristics of the variety are different from those in the submission.

15. Even though the purpose of notification is for business promotion purpose for the owner of a variety and even though public utilization of the variety is not legally prevented, the ownership of the variety is protected.

16. The evidence discussed in this paper may be still far from plant variety protection under the UPOV Convention. It represents, however, an effort to come a step closer to UPOV regulations. It is strongly hoped that Thailand will have a Plant Breeders' Rights Act along with the Patent Act and Copyright Act which are already implemented.

CLOSING ADDRESS

by

Barry Greengrass, Vice Secretary-General, UPOV

Ladies and Gentlemen,

It is a very short time since a UPOV mission, in which I participated, visited China for the first time and met Mr. Song Zehou, Director General, Department of Rural Science and Technology, SSTCC, and his colleagues. As a result of that mission, it was agreed that this, the third UPOV Seminar on the Nature of and Rationale for the Protection of New Varieties Under the UPOV Convention, would be held in Beijing. An Organizing Committee was formed and the result was the excellent Seminar that we have enjoyed over the last two days. The facilities and the support services provided have been first class. The hard work and commitment and determination to get all the details right have been quite remarkable, and I would like to express the thanks of Dr. Arpad Bogsch, Secretary-General of UPOV, and of the UPOV Office to all who have been involved.

I would like expressly to thank the invited participants from countries of the Asia/Pacific Region for their participation and the keen interest with which they have followed and joined in our proceedings. UPOV has a reputation for providing a friendly environment for the conduct of its business, and I feel that together we have already extended this reputation into the Asia/Pacific Region.

The thanks of the UPOV Office must also be expressed to the interpreters and all others whose services have enabled our Seminar to succeed.

The importance attached to our Seminar by China was evidenced by the presence at our opening of the Vice-Chairman of the State Science and Technology Commission and other high officials of the Government and Institutions of China.

For officials from the Office of UPOV, our visit to China was crowned, and the high importance attached by China to intellectual property questions, including plant variety rights, was marked, by the high honor extended to the Director General of the World Intellectual Property Organization, who is also Secretary-General of UPOV, and to officials from the Office of UPOV when we were received by Jiang Zemin, President of China, plant variety protection received specific mention in the course of the reception.

Many thanks to you all. We think we have further strengthened the knowledge of and interest in plant variety protection in the Region in the course of this Seminar.

CLOSING ADDRESS

by

Mr. Song Zehou, Director-General,
Department of Rural Science and Technology,
State Science and Technology Commission of China

Ladies and Gentlemen,

After two days of discussions and exchanges of views by specialists and representatives from the participating countries, the Regional Seminar on the Nature of and Rationale for the Protection of Plant Varieties under the UPOV Convention is on the point of closing. I would like to express our thanks to Dr. Bogsch, Director-General of the World Intellectual Property Organization and concurrent Secretary-General of the International Union for the Protection of New Varieties of Plants, Mr. Greengrass, Vice Secretary-General of UPOV, and specialists and representatives from all participating countries for their joint efforts and close cooperation in the Seminar. I warmly congratulate you on the complete success of the Seminar.

This Seminar has contributed to an overall introduction to the current situation and development in the international protection of new plant varieties. The Seminar gave the participants a good occasion to study and discuss a possible cooperation in the field of the protection of new plant varieties among countries all over the world. The representatives have introduced their experiences with the notion of the protection of new plant varieties in their countries and submitted their papers to the Seminar. The purpose of the Seminar has been accomplished as it was planned. The Seminar has played an important role in speeding up the legislation of the protection of new plant varieties in China. It will promote the work on the protection of new plant varieties and the protection of intellectural property.

This Seminar is not only a forum for exchanging experience and making cooperation between the nations in the world, but also a place of friendly contact for people working in the field of plant variety protection. Although time was very short, we have promoted friendship and enhanced understanding. I believe that each of you will treasure the friendship between us. In the years to come, we will be able to get in touch with one another in various means in a common effort to protect new plant varieties in the world as a whole.

I wish our friendship will continue for ever, and our undertaking will grow and florish.

Thank you!

LIST OF PARTICIPANTS

I. COUNTRIES FROM THE ASIAN AND PACIFIC REGION

BANGLADESH

Dr. Muhammed NASIRUDDIN, Chief Plant Breeder and Head of the Genetic Resources and Seed Division, Bangladesh Rice Research Institute, Gazipur 1701 (Phone: 880-2-18.03.17; Fax: 880-2-86.38.24)

Dr. Tulshi DAS, Chief Plant Breeder, Plant Breeding Division, Bangladesh Rice Research Institute (BRRI), Regional Station Sashangacha, Comilla, P.O. Box 58 (Phone: 081-69.45)

CHINA

Mr. SHEN Maoxiang, Division Director, Department of Rural Science and Technology, State Science and Technology Commission of China, 15B Fuxin Road, 100862 Beijing

Mr. XIAO Yunlai, Deputy Division Chief, Division of International Exchange and Cooperation, Department of Science and Technology, Ministry of Agriculture, 11 Nong Zhanguan Nanli, 100026 Beijing
(Phone: 86-1-500.43.17; Fax: 86-1-500.24.48; Telex: 22233 MAGR CN)

INDIA

Dr. S. NATESH, Scientific Officer, Department of Biotechnology, Ministry of Industry, Block No. 2, CGO Complex, Lodi Road, New Delhi 110 003
(Phone: 91-11-436.08.99 ext. 243; Fax: 91-11-436.38.84)

Dr. Mangla RAI, Assistant Director General (Seeds), Indian Council of Agricultural Research (ICAR), Krishi Bhavan, New Delhi 110 001
(Phone: 91-11-38.21.46; Fax: 91-11-38.72.93; Telex: 62249 ICAR IN)

INDONESIA

Mr. Tjahjo DAMIRIN, Organization and Law Bureau, Ministry of Agriculture, Jl. Harsono RM No. 3, Ragman-Pasar Minggu, Jakarta Selatan 12550
(Phone: 62-21-780.40.36; Telex: 66112 DEPTAN AI)

Ir. Ferial LUBIS (Mrs.), International Cooperation Bureau, Ministry of Agriculture, Jl. Harsono, RM No. 3, Ragman-Pasar Minggu, Jakarta 12550
(Phone: 62-21-780.41.76; Fax: 62-21-780.43.76; Telex: 66112 DEPTAN AI)

MALAYSIA

Mrs. Fatimah Bt. Md. ANWAR, Agriculture Officer, Commodity Development Branch, Department of Agriculture, Bumbong Lima, Seberang Perai, 13200 Kepala Bata, Pulau Pinang
(Phone: 60-4-35.11.24; Fax: 60-4-35.19.01)

Mrs. Norma OTHMAN, Agriculture Officer, Commodity Development Branch, Department of Agriculture, Wisma Tani, Jalan Sultan Salahuddin, 50632 Kuala Lumpur
(Phone: 60-3-292.56.74; Fax: 60-3-298.57.46)

PAKISTAN

Mr. Rashid ANWAR, Director, Plant Genetic Resources Institute (PGRI), National Agricultural Research Centre (NARC), 45500 Islamabad
(Phone: 92-51-24.01.46; Fax: 92-51-24.01.04; Telex: 5604 PARC PK)

Dr. Bashir Ahmed MALIK, National Coordinator (Food Legumes), National Agricultural Research Centre (NARC), 45500 Islamabad
(Phone: 92-51-24.04.68; Fax: 92-51-24.01.04; Telex: 5604 PARC PK)

PHILIPPINES

Dr. Manuel L. LOGROÑO, Institute of Plant Breeding, University of the Philippines, Los Baños College, Laguna 4031
(Phone: 63-94-22.98; Fax: 63-94-34.38 or 63-2-817.05.98; Telex: 7525 4909)

Ms. Erlinda PILI-SEVILLA, Chief, National Seed Quality Control Services, Bureau of Plant Industry, Department of Agriculture, San Andres, Malate, Metro Manila (Phone: 63-2-50.08.97; Fax: 63-2-521.76.50)

Mr. Gengchen HAN, Pioneer Overseas Corporation, Regional Office, Ground Floor, Renaissance Bldg, 215 Salcedo Street, Legaspi Village Makati, Metro Manila 1200
(Phone: 63-2-815.12.57 or 815.13.13; Fax: 63-2-815.63.79; Telex: 64260 PIONEER PN)

REPUBLIC OF KOREA

Mr. CHO, Jeonghan, Director, Agricultural Materials Division, Ministry of Agriculture, Forestry and Fisheries, Kwacheon, Seoul
(Phone: 82-2-503.72.54; Fax: 82-2-503.72.49)

Mr. HA, Dongho, Deputy Director, Vegetables Division, Ministry of Agriculture, Forestry and Fisheries, Kwacheon, Seoul
(Phone: 82-2-503.72.73; Fax: 82-2-503.72.49)

Dr. LEE, Seonghee, Head, Senior Researcher, Crop Experiment Station, Rural Development Administration, Suweon, Kyeonggido 441-100
(Phone: 82-331-282.38.23; Fax: 82-331-282.45.60)

THAILAND

Dr. Vichitr BENJASIL, Deputy Director-General, Department of Agriculture, Ministry of Agriculture and Cooperatives, Kaset Klang, Paholyothin Road, Chatuchak, Bangkok 10900
(Phone: 66-2-579.48.55; Fax: 66-2-561.50.24; Telex: 84103 DOA)

Dr. Prasoot SITTISUANG, Director, Rice Research Institute, Department of Agriculture, Ministry of Agriculture and Cooperatives, Kaset Klang, Paholyothin Road, Chatuchak, Bangkok 10900
(Phone: 66-2-579.75.60; Fax: 66-2-561.17.32; Telex: 84103 DOA TH)

II. OTHER COUNTRIES

Mr. QUELE, Attaché, Embassy of France, Beijing, China
(Fax: 86-1-532.38.51)

Mr. D.M. VERMERRIS, Director, Vanderhave International B.V., P.O. Box 1, 4420 AA Kapelle, Netherlands
(Phone: 0031-1102-479.11; Fax: 0031-1102-442.24; Telex: 55051)

III. ORGANIZATIONS

FAO - Food and Agriculture Organization of the United Nations

Dr. David C.S. TAY, Seed Production Officer, c/o FAO Regional Office for Asia and the Pacific, Phra Atit Road, 10200 Bangkok, Thailand
(Tel.: 66-2-579.75.45; Fax: 66-2-561.48.34; Telex: 82815 FOODAG TH)

Mr. Jean-Pierre CHAIRADIA-BOUSQUET, Legal Office, Via delle Terme di Caracalla, 00100 Rome, Italy (Tel: 6-57-97-3956, Fax: 6-57-97-4408)

AIPPI - International Association for the Protection of Industrial Property

Mr. Lulin GAO, Vice-Chairman of the Chinese Group of AIPPI, Commissioner of the Patent Office of the People's Republic of China, College Road, P.O. Box 8020, Beijing, China
(Phone: 86-1-202.11.77; Fax: 86-1-201.96.15; Telex: 22541 POPRC CN)

WIPO - World Intellectual Property Organization

Mr. LI Jiahao, Senior Counsellor, Development Cooperation and External Relations Bureau for Asia and the Pacific, 34, chemin des Colombettes, 1211 Geneva 20, Switzerland
(Phone: 41-22-730.90.44; Fax: 41-22-733.54.28; Telex: 412 912 OMPI CH)

IV. LECTURERS

Mr. Yoshito IWASA, Senior Managing Director, Sakata Seed Corp., 1-7 Nagata Higashi 3-chome, Minami-ku, Yokohama, Japan
(Phone: 81-45-715.21.11; Fax: 81-45-712.13.30)

Mr. Kôji KANAZAWA, Examiner, Seeds and Seedlings Division, Ministry of Agriculture, Forestry and Fisheries, 1-2-1 Kasumigaseki, Chiyoda-ku, Tokyo 100, Japan
(Phone: 81-3-35.91.05.24; Fax: 81-3-35.02.65.72)

Mr. Bart P. KIEWIET, President, Board of Plant Breeders' Rights, Postbus 104, 6700 AC Wageningen, Netherlands
(Phone: 0032-8370-190.31; Fax: 0032-8370-258.67)

Mr. WANG Keping, Senior Agronomist, Head, China National Food Administration Station, Ministry of Agriculture, 11 Nong Zhan Guan Nan, Room 1121, 100026 Beijing, China
(Phone: 86-1-500.33.66 ext. 31.21)

Mr. Grant WATSON, Acting Commissioner, Plant Breeders' Rights, Plant Products Division, K.W. Neatby Bldg., 960 Carling Ave., Ottawa, Ontario K1A 0C6, Canada
(Phone: 1-613-995.79.00; Fax: 1-613-992.52.19)

Mr. ZHUANG Qiaosheng, Research Professor, Institute of Crop Breeding and Cultivation, Chinese Academy of Agricultural Sciences, Beijing 100081, China

V. CHINESE PARTICIPANTS

Mr. HUI Yongzheng, Vice-President, State Science and Technology Commission of China (SSTCC), 15B Fuxing Road, Beijing 100862

Mr. HONG Fuzeng, Vice-Minister, Ministry of Agriculture, 11 Nong Zhanguan Nanli, Chaoyang District, Beijing 100026

Mr. ZHU Guangyao, Vice-Minister, Ministry of Forestry, Beijing

Mr. WANG Lianzheng, President, Research Professor, Chinese Academy of Agricultural Sciences, 30 Bai Shi Qiao Road, Beijing 100081

Mr. XIU Zhihong, Vice-President, Chinese Academy of Sciences, Beijing

Mr. MA Lianyuan, Vice-Director, China National Patent Bureau, Beijing

Dr. SONG Zehou, Director General, Department of Rural Science and Technology, State Science and Technology Commission of China (SSTCC), 15B Fuxing Road, 100862 Beijing
(Fax: 86-1-851.50.04; Telex: 22349 SSTCC CN)

Mr. FEI Kaiwei, Director General, Department of Science and Technology, Ministry of Agriculture, 11 Nong Zhanguan Nanli, Chaoyang District, Beijing 100026

Mr. LIU Xiaozhang, Deputy Director General, Department of Science and Technology, Ministry of Forestry, Beijing

Mr. QUIA Dexi, Director, Department of Law, China National Patent Bureau, Beijing

Mr. TONG Fengqin, Vice-Director, Coordination Bureau, Chinese Academy of Sciences, Beijing

Mr. TANG Chengyuan, Vice-Director, Department of Treaty and Law, Ministry of Foreign Affairs, Beijing

Mr. XIN Naiquan, Director, Department of Scientific Research Management, Chinese Academy of Agricultural Sciences, 30 Bai Shi Qiao Road, Beijing 100081
(Phone: 86-1-832.18.84; Fax: 86-1-831-65.45; Telex: 222 720 CAAS CN)

Mr. SHEN Jinpu, Research Professor, Department of Scientific Research Management, Chinese Academy of Agricultural Sciences, 30 Bai Shi Qiao Road, Beijing 100081
(Phone: 86-1-832.18.84; Fax: 86-1-831-65.45; Telex: 222 720 CAAS CN)

Mr. XUAN Zengpei, Division Chief, Department of Cooperation, State Science and Technology Commission of China (SSTCC), 15B Fuxing Road, Beijing 100862

Mrs. HANG Sanba, Division Chief, Department of Rural Science and Technology, State Science and Technology Commission of China, 15B Fuxing Road, 100862 Beijing
(Phone: 86-1-851.21.51; Fax: 86-1-851.50.04; Telex: 22349 SSTCC CN)

Mr. CHEN Guotai, Division Chief, Department of Rural Science and Technology, State Science and Technology Commission of China, 15B Fuxing Road, 100862 Beijing
(Phone: 86-1-851.21.51; Fax: 86-1-851.50.04; Telex: 22349 SSTCC CN)

Mr. LIOU Xinghai, Division Chief, Department of Science and Technology, Ministry of Agriculture, 11 Nong Zhanguan Nanli, Chaoyang District, Beijing 100026

Mr. BAI Yuliang, Division Chief, Scientific Research Division, Beijing Agricultural University, 2 Yuan Mingyuan West Road, Beijing 100094
(Phone: 86-1-258.22.44; Telex: 86-1-222 487 BAU CN)

Mr. CHEN Jian, Vice-Director, Institute of Crop Germplasm Resources, Chinese Academy of Agricultural Sciences, 30 Bai Shi Qiao Road, Beijing 100081

Mr. HUANG Hongtao, Associate Research Professor, Department of Scientific Research Management, Chinese Academy of Agricultural Sciences, 30 Bai Shi Quiao Road, Beijing 100081
(Phone: 86-1-832.33.06; Fax: 86-1-831.65.45; Telex: 222 720 CAAS CN)

Mrs. WANG Chen, Division Chief, Coordination Bureau, Chinese Academy of Sciences, Beijing

Mr. SU Wei, Vice Division Chief, Department of Treaty and Law, Ministry of Foreign Affairs, Beijing

Mr. ZHANG Yanqiu, Vice Division Chief, Seed Division, Department of Agriculture, Ministry of Agriculture, 11 Nong Zhanguan NanLi, Chaoyang District, Beijing 100026
(Phone: 86-1-500.33.66-2802; Telex: 22233 MAGR CN)

Ms. LIU Deping, Department of Political Reformation, Ministry of Agriculture, 11 Nong Zhanguan NanLi, Chaoyang District, Beijing 100026
(Phone: 86-1-500.33.66-2505; Telex: 22233 MAGR CN)

Mr. HUANG Jiajun, Department of Science and Technology, Ministry of Agriculture, 11 Nong Zhanguan NanLi, Chaoyang District, Beijing 100026
(Phone: 86-1-500.33.66-3124; Telex: 22233 MAGR CN)

Mr. ZHANG Yushan, Senior Engineer, Division Chief, Department of Protection, Ministry of Forestry, Beijing

Mr. HE Lichun, Senior Engineer, Department of Science and Technology, Ministry of Forestry, Beijing

Mr. LU De, Project Officer, Department of Foreign Affairs, Ministry of Forestry, Beijing (Phone: 86-1-421.32.78)

Mr. WANG Qi, Director, Senior Engineer, Seed and Seedlings Management Station, Ministry of Forestry, Beijing

Mr. LI Ansheng, Associate Research Professor, Research Institute of Genetics, Chinese Academy of Sciences, Beijing

Mr. GUO Xuexing, Associate Research Professor, Chengdu Research Institute of Biology, Chinese Academy of Sciences, Chengdu

Ms. SONG Jianhua, Department of Law, China National Patent Bureau, Beijing

Ms. GOU Shan, Department of Law, China National Patent Bureau, Beijing

Mr. LIU Wenbo, Division Chief, Division of Metrological Criterion, China National Supervision Bureau of Technology, Beijing

Mr. FANG Jiahe, Associate Research Professor, Institute of Crop Germplasm Resources, Chinese Academy of Agricultural Sciences, 30 Bai Shi Qiao Road, Beijing 100081
(Phone: 86-1-831.44.33-2723; Fax: 86-1-831.65.45; Telex: 222 720 CAAS CN)

Mr. WANG Xiangkun, Professor, Beijing Agricultural University, 2 Yuan Ming Yuan West Road, Beijing 100094
(Phone: 86-1-258.22.44-360; Telex: 222 487 BAU CN)

Mr. SUN Qixin, Professor, Beijing Agricultural University, 2 Yuan Ming Yuan West Road, 100094 Beijing (Phone: 86-1-258.22.44-360; Telex: 222 487 BAU CN)

Mr. WANG Huoran, Associate Research Professor, Section Director, Research Institute of Forestry, Chinese Academy of Forestry Sciences, Beijing
(Phone: 86-1-258.22.11-645)

Mr. GU Wanchun, Associate Research Professor, Director of Section, Research Institute of Forestry, Chinese Academy of Forestry Sciences, Beijing
(Phone: 86-1-258.22.11-640)

Mr. ZHANG Zhiyi, Associate Research Professor, Beijing Forestry University
(Phone: 86-1-256.88.11-461)

Mr. ZHAO Qingchung, Vice-Director, Seed Corporation, Agricultural Bureau of Beijing Municipality (Phone: 86-1-202.55.53)

Mrs. GUI Fu, Senior Engineer, Division Chief, Forestry Bureau of Beijing Municipality

Mr. ZHANG Xueping, Director, Vegetable Centre, Development Department, Beijing Academy of Agricultural Sciences (Phone: 86-1-841.44.33-3042)

Mr. DU Zuodong, Bureau of Law and Regulation, State Council, Beijing
(Phone: 86-1-602.47.80)

Ms. LIN Xin, Department of Policy, State Science and Technology Commission of China (SSTCC), 15B Fuxing Road, Beijing 100862
(Fax: 86-1-851.50.04; Telex: 22349 SSTCC CN)

Mr. JIANG Maosen, Department of Rural Science and Technology, State Science and Technology Commission of China (SSTCC), 15B Fuxing Road, Beijing 100862
(Phone: 86-1-851.21.51; Fax: 86-1-851.50.04; Telex: 22349 SSTCC CN)

VII. CHINESE OTHER PARTICIPANTS

Mrs. LI Maoming, Vice Secretary-General, State Science and Technology Commission of China (SSTCC)

Mr. CHANG Ping, Director, General Office, State Science and Technology Commission of China (SSTCC)

Mr. JIN Xiaoming, Vice-Director, Department of Cooperation, State Science and Technology Commission of China (SSTCC)

Mr. LI Xueyong, Vice-Director, Support and Finance Department, State Science and Technology Commission of China (SSTCC)

Mrs. LI Xiaolin, Vice-Director, Department of Rural Science and Technology, State Science and Technology Commission of China (SSTCC)

Mr. WANG Hengbi, Vice-Director, Department of Rural Science and Technology, State Science and Technology Commission of China (SSTCC)

Mr. SUN Zhongqian, Senior Engineer, Department of Rural Science and Technology, State Science and Technology Commission of China (SSTCC)

Mr. WU Zhenxiang, Representative, First Secretary, Chinese Resident Office in Geneva, Switzerland

Mr. ZHAN Chunsha, Vice-Chief, General Office, State Science and Technology Commission of China (SSTCC)

Mr. YANG Zirong, General Office, State Science and Technology Commission of China (SSTCC)

Mr. HU Xiaojun, General Office, State Science and Technology Commission of China (SSTCC)

Mrs. WANG Huiling, State Science and Technology Commission of China (SSTCC)

Mrs. GUO Zengyan, Deputy Division Chief, Department of Rural Science and Technology, State Science and Technology Commission of China (SSTCC)

Mr. CAO Yihua, Deputy Division Chief, Department of Rural Science and Technology, State Science and Technology Commission of China (SSTCC)

Mr. WANG Zhixue, Deputy Division Chief, Department of Rural Science and Technology, State Science and Technology Commission of China (SSTCC)

Mr. OU Yangxiaoguang, Vice Director, Office of the World Bank, State Science and Technology Commission of China (SSTCC)

Mr. WU Wei, Associate Professor, Department of Rural Science and Technology, State Science and Technology Commission of China (SSTCC), 15B Fuxing Foard, Beijing 100862 (Phone: 86-1-851.21.81)

Mrs. HU Jinghua, Engineer, Department of Rural Science and Technology, State Science and Technology Commission of China (SSTCC)

Mr. YIN Guan, Chief Division, Department of Comprehensive Planning, State Science and Technology Commission of China (SSTCC)

Mr. YU Jian, Deputy Division Chief, Department of Comprehensive Planning, State Science and Technology Commission of China (SSTCC)

Mr. MENG Fansen, Division Chief, Department of Comprehensive Planning, State Science and Technology Commission of China (SSTCC)

Mr. ZHENG Yichun, Deputy Division Chief, Department of Comprehensive Planning, State Science and Technology Commission of China (SSTCC)

Mrs. GUO Xiaolin, Department of Comprehensive Planning, State Science and Technology Commission of China (SSTCC)

Mr. YUAN Guangzeng, Vice Division Chief, Department of Comprehensive Planning, State Science and Technology Commission of China (SSTCC)

Mr. TIAN Yie, Department of Comprehensive Planning, State Science and Technology Commission of China (SSTCC)

Mr. QUAN Changhui, Vice-Director, Department of Political Reformation, Ministry of Agriculture

Mr. LI Wenxing, Seed Division, Department of Agriculture, Ministry of Agriculture

Mr. BA Lianzhu, Department of Political Reformation, Ministry of Forestry

Mr. REN Xuan, Director, Management Department, China Seed Corporation

Mr. FAN Weimin, Vice Chief of Division, Division of Law, Patent Department, China International Trade Promotion Commission

Mrs. ZHONG Mingde, Coordinator, East Asia Office, International Board for Plant Genetic Resources c/o CAAS, No. 30, Bai Shi Qiao road, Beijing 100081 (Phone: 86-1-831.65.94 (direct); Telex: 222 720 CAAS CN)

Mr. YANG Xiongnian, Department of Science and Technology, Ministry of Agriculutre, 11 Nong Zhanguan NanLi, Chaoyang District, Beijing 100026 (Phone: 86-1-500.42.34; Telex: 22233 MAAF CN)

VIII. NEWS AGENCIES

Xinhua News Agency

China Central Television

Central People's Broadcasting Station

People's Daily

Guangming Daily

Science and Technology Daily

Farmers' Daily

IX. STAFF OF THE SEMINAR SERVICE GROUP

Mr. SHI Suoda, Department of Scientific Research Management, Chinese Academy of Agricultural Sciences, 30 Bai Shiqiao Road, Beijing 100081
(Phone: 86-1-831.44.33-25.08; Fax: 86-1-831.65.45; Telex: 222 720 CAAS CN)

Mrs. HUANG Jizhang, Department of Scientific Research Management, Chinese Academy of Agricultural Sciences, 30 Bai Shiqiao Road, Beijing 100081
(Phone: 86-1-832.33.06; Fax: 86-1-831.65.45; Telex: 222 720 CAAS CN)

Mrs. LI Jianping, Department of Scientific Research Management, Chinese Academy of Agricultural Sciences, 30 Bai Shiqiao Road, Beijing 100081
(Phone: 86-1-831.65.31; Fax: 86-1-831.65.45; Telex: 222 720 CAAS CN)

Mr. QIAN Yongzhong, Department of Scientific Research Management, Chinese Academy of Agricultural Sciences, 30 Bai Shiqiao Road, Beijing 100081
(Phone: 86-1-831.65.31; Fax: 86-1-831.65.45; Telex: 222 720 CAAS CN)

Miss HUANG Ningyan, Department of Rural Science and Technology, State Science and Technology Commission of China (SSTCC), 15B Fuxing Road, Beijing 100862
(Phone: 86-1-851.21.51; Fax: 86-1-50.04; Telex: 22349 SSTCC CN)

Miss SHAO Mei, Department of Rural Science and Technology, State Science and Technology Commission of China (SSTCC), 15B Fuxing Road, Beijing 100862
(Phone: 86-1-851.21.51; Fax: 86-1-50.04; Telex: 22349 SSTCC CN)

Mr. ZHANG Yanqing, Department of Scientific Research Management, Chinese Academy of Agricultural Sciences, 30 Bai Shiqiao Road, Beijing 100081
(Phone: 86-1-831.44.33-25.08; Fax: 86-1-831.65.45; Telex: 222 720 CAAS CN)

Mrs. LIOU Ruiying, Departments of Scientific Research Management, Chinese Academy of Agricultural Sciences, 30 Bai Shiqiao Road, Beijing 100081
(Phone: 86-1-832.36.28; Fax: 86-1-831.65.45; Telex 222 720 CAAS CN)

Mrs. SHANG Shuhua, Department of Scientific Research Management, Chinese Academy of Agricultural Sciences, 30 Bai Shiqiao Road, Beijing 100081
(Phone: 86-1-831.44.33; Fax: 86-1-831.65.45; Telex 222 720 CAAS CN)

Mrs. Hao Shaohua, Department of Scientific Research Management, Chinese Academy of Agricultural Sciences, 30 Bai Shiqiao Road, Beijing 100081
(Phone: 86-1-831.44.33; Fax: 86-1-831.65.45; Telex 222 720 CAAS CN)

Mrs. FANG Baoqin, International Cooperation Department, Chinese Academy of Agricultural Sciences, 30 Bai Shiqiao Road, Beijing 100081
(Phone: 86-1-832.33.06; Fax: 86-1-831.65.45; Telex 222 720 CAAS CN)

Mr. LIOU Zhanwen, Institute of Crop Germplasm Resources, Chinese Academy of Agricultural Sciences, 30 Bai Shiqiao Road, Beijing 100081

Mr. PAN Xuchun, Scien-Tech Information Centre, Chinese Academy of Agricultural Sciences, 30 Bai Shiqiao Road, Beijing 100081

Mrs. SUN Hong, Department of Scientific Research Management, Chinese Academy of Agricultural Sciences, 30 Bai Shiqiao Road, Beijing 100081
(Phone: 86-1-831.44.33; Fax: 86-1-831.65.45; Telex 222 720 CAAS CN)

VI. OFFICE OF UPOV

Dr. Arpad BOGSCH, Secretary-General, UPOV, 34, chemin des Colombettes, 1211 Geneva 20, Switzerland
(Tel.: 41-22-730.92.22; Fax: 41-22-733.54.28; Telex: 412 912 OMPI CH)

Mr. Barry GREENGRASS, Vice Secretary-General, UPOV, 34, chemin des Colombettes, 1211 Geneva 20, Switzerland
(Tel.: 41-22-730.91.55; Fax: 41-22-733.54.28; Telex: 412 912 OMPI CH)

Mr. Makoto TABATA, Senior Program Officer, UPOV, 34, chemin des Colombettes, 1211 Geneva 20, Switzerland
(Tel.: 41-22-730.95.65; Fax: 41-22-733.54.28; Telex: 412 912 OMPI CH)

BIOGRAPHICAL NOTES

I. UPOV OFFICIALS

ARPAD BOGSCH

United States citizen.
Born in Budapest in 1919.

Doctor of Laws, University of Budapest, Paris and Washington (George Washington University).

Principal Positions:

Attorney of Law (Budapest, 1942-48); Legal Officer, UNESCO (Paris, 1948-54); Legal Counsellor, US Copyright Office (Washington, D.C., 1954-63); First Deputy Director-General, United International Bureaux for the Protection of Intellectual Property (BIRPI) (Geneva, 1963-70) and World Intellectual Property Organization (WIPO) (Geneva, 1970-73); Director General, WIPO, and Secretary-General, International Union for the Protection of New Varieties of Plants (UPOV) (Geneva, since 1973).

Honorary Degrees:

Doctor honoris causa (Law): University of Jabalpur (1978), George Washington University (Washington, D.C., 1985), Colombo (1987), Kyung Hee University (Republic of Korea, 1991), Eötvös Lóránd University (Budapest, 1991), Bucharest (1991), Delhi (1992), Institute of State and Law of the Russian Academy of Sciences, Moscow (1993).

Honorary Professor of Law, Peking University (1991).

Decorations from:

Sweden (1967), Austria (1977), Spain (1980), Republic of Korea, Senegal and the International Olympic Committee (1981), Bulgaria (1985), France, Japan and Thailand (1986), Argentina (1990), Hungary (1991), Senegal, Colombia and France (1992), Germany (1993).

BARRY GREENGRASS

Mr. Barry Greengrass, a national of the United Kingdom, has been Vice Secretary-General of the International Union for the Protection of New Varieties of Plants (UPOV) since June 1988 when he joined the staff of UPOV.

Mr. Greengrass was born in the United Kingdom in 1935. He is a Law Graduate from Keble College, Oxford, and a Solicitor of the Supreme Court in the United Kingdom. After practicing law, he joined the Nickerson Group as Legal Adviser in 1965 and became Commercial Director of Nickerson Rothwell Plant Breeders Ltd. in 1967. He was based in the United States of America as General Manager of North American Plant Breeders from 1973 to 1976 and responsible for Nickerson developments in field crops in Europe from 1976 to 1981. From 1981 to 1983, he was responsible for the Direct Marketing of Agricultural Chemicals by the Shell International Chemical Company Ltd., and from 1983 to 1986, he served as Commercial Director, The Nickerson Seed Company Ltd. From 1986 to 1988, he was Manager Agricultural Biotechnology in the Shell International Chemical Company Ltd.

MAKOTO TABATA

Mr. Makoto Tabata, a national of Japan, has been Senior Program Officer of UPOV since 1990. Prior to his present post, he worked from 1984 to 1990 in the Seeds and Seedlings Division, Agricultural Production Bureau, Ministry of Agriculture, Forestry and Fisheries, Tokyo, Japan. From 1985 to 1988 he worked also as an Associate Officer of UPOV .

Mr. Tabata was born in Tokyo, Japan, in 1955. He completed his studies in agricultural botany at Hokkaido University, Sapporo, Japan, in 1978 and studied agricultural economy at the University of Göttingen, Germany, from 1981 to 1983.

Mr. Tabata joined the Ministry of Agriculture, Forestry and Fisheries, Tokyo, Japan, in 1978 and worked in the Secretariat of the Agriculture, Forestry and Fisheries Research Council. From 1983 to 1985 he was Chief of the Wheat and Barley Production Section of the Crop Production Division of the Agricultural Production Bureau.

II. SPEAKERS

YOSHITO IWASA

Mr. Yoshito Iwasa, a national of Japan, has been Managing Director of Sakata Seed Company since 1992.

Mr. Iwasa was born in 1931. He studied horticulture at the Faculty of Horticulture of Chiba University. Since joining the Sakata Seed Company in 1956, Mr. Iwasa has been active in the commercialization of vegetables and flower seeds. He has been a member of the Board of Sakata Seed Company since 1972. Mr. Iwasa is also the acting president of the flower section of the Japan Seed Trade Association.

KOJI KANAZAWA

Mr. Kôji Kanazawa, a national of Japan, was born in 1945. He has been an examiner of the Seeds and Seedlings Division, Agricultural Production Bureau, of the Ministry of Agriculture, Forestry and Fisheries of Japan since 1984.

Mr. Kanazawa studied horticulture at the Faculty of Agriculture of Saga University and received a Master's degree in agriculture from Kyûshû University in 1973. Mr. Kanazawa joined the Ministry of Agriculture, Forestry and Fisheries in 1981 as a seed inspector.

As Examiner of the Seeds and Seedlings Division, Mr. Kanazawa is responsible for DUS testing of flower varieties and for the drafting of Test Guidelines for flower species.

Mr. Kanazawa has been a regular member of the Technical Working Party for Ornamental Plants and Forest Trees of UPOV since 1990.

BART P. KIEWIET

Mr. Kiewiet, a national of the Netherlands, has been Chairman of the Board for Plant Breeders' Rights in the Netherlands since July 1988. In that capacity he represents the Dutch Government in the Council of UPOV. Mr. Kiewiet combines the afore-mentioned function with the vice-presidency of the Dutch Administrative Court of Appeal for Trade and Industry.

Mr. Kiewiet was born in Haarlem (Netherlands) in 1947. He has a law degree of the Free University of Amsterdam. Before holding his present offices, he was, from 1982, Secretary-General of the Dutch Industrial Board for Ornamentals in the Hague. In that same period he was a member of the appeal section of the Board for Plant Breeders' Rights.

WANG KEPING

Mr. Wang, a national of the People's Republic of China, was born on December 25, 1939. Mr. Wang, a senior agronomist, is acting as Head of the China National Food Administration Station of the Ministry of Agriculture of the People's Republic of China.

Professional Experience and Positions

1961 - 1964 Majored in agronomy at Nanjing Agricultural College

1964 - 1972 Technologist in the Science and Technology Bureau, Ministry of Agriculture, People's Republic of China

1972 - 1982 Agronomist with Beijing Seed Company

1982 - 1991 Deputy Head and Head of Section of Planning and Finance Division, Agriculture Bureau, Ministry of Agriculture, People's Republic of China

1991 - 1993 Deputy Head and Head of China National Seed Administration Station, Ministry of Agriculture, People's Republic of China.

GRANT WATSON

Mr. Grant Watson, a national of Canada, has been an Associate Director of the Plant Products Division of Agriculture Canada since 1990. Mr. Watson is responsible for the administration of the Plant Breeders' Rights Act, the registration of all agricultural crop varieties under the Canada Seeds Act as well as the development of a system to regulate plants developed through biotechnology.

Mr. Watson graduated from the University of Guelph in 1972 and has held various positions in Agriculture Canada related to regulating the sale of seed in Canada.

ZHUANG QIAOSHENG

Mr. Zhuang, a national of the People's Republic of China, was born on August 5, 1916, in Fujian Province.

Education — B.S., graduated from the Department of Agronomy, University of Nanjing, China, in 1939

Profession — Currently is a research professor and wheat breeder in the Institute of Crop Breeding and Cultivation, Chinese Academy of Agricultural Sciences.

Experience — Engaged in wheat breeding and related studies for more than 50 years. Developed more than 20 wheat cultivars which have been released for commercial production at various times since the mid-1950s. Project leader of the National Wheat Breeding Network since 1983. President of the Crop Science Society of China since 1988. Elected as a Member of the Chinese Academy of Sciences in 1991.

Publications — More than 40 papers on wheat breeding and related studies.