

Session 5

FACILITATION OF TRADE AND MARKET DEVELOPMENT

Chairperson: Mr. JOHN C. KEDERA, Managing Director, Kenya Plant Health Inspectorate Service (KEPHIS) (Kenya)

▶ **Overview of the regulatory framework in seed trade**

Mr. JOSEPH CORTES, Seed Science Center, Iowa State University (United States of America)

▶ **The role of international certification in facilitating trade and market developments**

Mr. MICHAEL RYAN, Head, OECD Codes and Schemes, Directorate for Trade and Agriculture, OECD

▶ **Phytosanitary measures and the international seed trade**

Mr. JEFFREY JONES, Senior Officer (Phytosanitary Capacity Building), International Plant Protection Convention (IPPC), Plant Production and Protection Division (AGP), Agriculture and Consumer Protection Department, FAO

▶ **Harmonization of seed testing for the facilitation of trade**

Mr. JOËL LÉCHAPPÉ, Director, National Seed Testing Station (SNES) (France)

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OVERVIEW OF THE REGULATORY FRAMEWORK IN SEED TRADE

Mr. JOSEPH CORTES*

My presentation will be divided into three parts. The first part will be an overview of the regulatory framework of seed trade from an international perspective. The second part will look at these regulatory frameworks from a regional perspective and, finally, we look at whether this makes any difference.

The seed science centre at Iowa State University took a decision about 10 years ago to work in the area of seed policy regulations, laws and harmonization to facilitate seed trade. It was a conscious decision and an effort to do something that would have a global meaning, so we stopped doing a lot of things that we had been doing at national level. We looked at it from the standpoint that world seed exports are very important, but there is a secondary importance that sometimes people tend to forget: every pound, every kilo of seed that is sold means that farmers somewhere in the world are getting improved varieties from high-quality seed.

When we look at seed trade, we also look at it from that perspective. It is something that we must do if we want to change some of the regions of the world in terms of how much they are producing and how well they produce.

In terms of the international regulation of seed trade, you all know there are the seed certification schemes, the seed testing areas, the phytosanitary measures and plant variety protection. Those are the four main pillars on which our international regulatory frameworks rest. Let's look at seed certification. We have two systems in the world: OECD with 57 country members which is a mandatory/compulsory system, and the one that exists in AOSCA which is a non-compulsory and non-mandatory system. You might ask which one is better; I would rather give the private sector the opportunity to answer that question. They are each probably comfortable with the systems they have, and there is really nothing better.

If we look at seed testing, it is ISTA that applies its rules around the world; there are 182 laboratories in 74 different countries. However, there are many countries that are not ISTA members, that are not OECD members, that are not AOSCA members, so we need to work closely with them to make sure that they also come into the system of the international schemes.

In terms of plant variety protection, UPOV is the one that is most recognized, or even the only one that is recognized and currently it has 67 country members.

In terms of the phytosanitary measures of the IPPC, I will not go into the details since we will have presentations on these measures from the IPPC and also from the national plant food sector organizations.

Regarding regional harmonization of seed regulatory frameworks to facilitative trade, 10 years ago Iowa State University started doing work on this in Central America. First, what we tried to do was identify those things that were a constraint to the trade. This is of course relevant when you have a regional variety release system. Then it seems that seed companies will have fewer costs, both in human resources and in time to release a variety from country to country. Thus you really have much to gain as you look at regional variety release systems as is the case in the EU. In terms of seed certification and accreditation, we work in trying to harmonize the standards of countries, in whatever the area might be. That means field and seed standards and one of the things that is common to our workshops and training sessions is that we make sure that OECD and AOSCA standards are met. We also encourage standards for the region to be a little bit tighter than the OECD or AOSCA standards.

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This is done in order to allow OECD or AOSCA accession by these countries at the time they wish to join. With ISTA, it's exactly the same thing. We insist they follow ISTA procedures, and eventually countries become ISTA members, or at least that is the expectation. Plant variety protection: we have already had a full session in regards to this so I do not need to tell you why it's so important. But we do work with countries in terms of developing plant variety protection and we do this in close relationship with UPOV. We also work very closely with ISTA as well as establishing new relationships with OECD. So for all of these things, we take into account that the private sector needs to be present. We have worked with the Asian Pacific Seed Trade Association, we have worked with the Latin American Seed Federation and the African Seed Trade Association, and shortly we will begin a relationship with the Seed Association of the Americas on a very specific project. So we always do our best to make sure there is private sector representation. You probably have heard several comments that have been made here today with regard to taking the private sector more into consideration when you are looking at the development of seed systems around the world. I totally agree. There needs to be participation from the private sector so that we can grow together; it has to be a partnership between the public and private sectors.

Finally, phytosanitary measures: the things we do in this area concern producing a quarantined pest list based on science. Thus in my presentation you will see what I mean by "based on science", and how there has been a reduction in the number of quarantined pests we have to deal with.

The other thing that is important with phytosanitary measures, and it is common to the rest of the work that we have done around the world, concerns difficulties some countries have to get a phytosanitary certificate, and how hard it is to get a seed export and import certificate. All of these things demand time and effort and people from the private sector constantly complain about this. We have also worked and continue working with countries to develop what we call seed import and export procedures and many of them already have manuals that are in the process of being implemented.

Let's look at the regional variety release systems in, for example, Central America. These have been approved and have been used for five different crops. Within the expanded Mercosur countries (the Mercosur countries plus Chile and Bolivia) there is technical agreement for five crops. The way the system works there is that you can accept data from the private sector. But most important is that you can test in one country, say Uruguay, but Uruguay will accept a year of testing from Brazil, and then you can apply for release, which would be a regional release. A similar system applies to Central America. In the East African community, there is an approved common catalogue, my only criticism being that it is only a catalogue because it is only a total of the different varieties that are released in the three different countries; it's not a common variety release system, but they do have a common catalogue. In the SADC countries, in the southern part of Africa, this involves 14 countries which approved a common variety release system in June of this year. This agreement will be signed in the coming days. There is a presidents' meeting of the SADC member countries in DRC as we speak so it's supposed to be signed by the end of this week. This measure has had the financial support of both USAID and the Swiss Agency for Development and Cooperation; it has been a joint cooperation between the two.

In ECOWAS, action was spearheaded by FAO and they have a common variety release system that was approved last year. This one is a little bit different in that in the 17 countries, if you release a variety in one country, you can market it in all 17 countries. However the system in SADC is that you need to release in two countries to be able to market it in all 14 countries. So it's a little bit different, but with the same common goal of getting more varieties released more quickly into the system.

Central America does have common seed certification standards as does expanded Mercosur and the Andean Pact. In addition to that, expanded Mercosur has seed certification accreditation in place and, obviously, seed testing using ISTA rules. The accreditation part relates to the fact that a person, laboratory or seed company can become accredited to conduct their own quality control on behalf of the government, under its supervision. They audit every year or two, whenever the government decides an audit should be done. I would emphasize here in regard to the Andean Pact, that a technical agreement was reached in all cases, except those in the Andean pact, because of the political differences between the countries and CAN, the community of nations, which has to reach agreement by consensus. So all five countries have to agree, and this is not possible at the moment.

In ECOWAS again, action was also spearheaded by FAO, but I forgot to mention that this was also funded by Genus, USAID, and FAO, the three being partners in this particular area of the world. The EAC also has common seed certification standards and they give accreditation for persons and/or entities. SADC works the same way; accreditation is possible; they have common standards and they use ISTA rules. Plant variety protection, which was set up with a lot of assistance from France, is in place. The SADC PVP draft protocol that we worked on very closely with UPOV has eventually resulted in five countries of the region having PVP legislation. They are not members of UPOV – but they will be eventually. The other thing is that as we move forward, there are other organizations that are better positioned than us to continue this effort; ARIPO is a very specific case. We have had very interesting conversations with regards to ARIPO, and I sincerely hope that we can move this forward. For phytosanitary measures, in Central America we have a quarantined pest list based on science and in Mercosur we have the same, plus a seed import and export manual has been developed. In the Andean Pact the pest list, the seed import and export manuals and even phytosanitary accreditation are pending. That means that a seed company that produces different types of crops can apply to do their own seed health testing and their own field inspections for quarantined pests; the same applies to ECOWAS and is still in the process of being developed. This is part of what Iowa State is doing with the ECOWAS countries, as well as assisting with seed import and export manuals. SADC already has both things: a quarantined pest list based on science, and seed import/export manuals.

This system has extended into the countries of the Asia Pacific region which are very interested, particularly because they produce so much vegetable seed. They were interested in having first of all a quarantined pest list based on science. They have also developed their own seed import and export manuals and they have phytosanitary accreditation for the five countries listed there. The only exception for the quarantined pest list is Vietnam. They are still working on that and have to report back to the IPPC. All of these things that we have talked about – do they really make an important difference? First of all, one should look at the quarantined pest list and how it has been reduced. When we started in Central America, there were 82 quarantined pests. The final number of pests that needed to be taken into account for movement of seed within the region was only two; In East Central Africa the figure went from 35 to seven; Mercosur from 50 to 10; Asia Pacific from 158 to 49. In the Andean Pact, 379 pests were analyzed and the number reduced to 112. The only reason you see such a high number there was due to the potato and the cassava; as you all know there are high numbers of viruses associated with these. Finally, SADC was down from 87 to 26. Other things that illustrate whether this is useful in Central America show that after two years of harmonized seed agreement, intra-regional trade has increased by 23 per cent. This is not our data, but data from the Latin American Seed Federation. Can we take credit for the increased intra-regional seed trade in Mercosur? Probably not a lot because there are many things that happened which have influenced the increase of seed trade but we did have something to do with it. For the first time in their history, Paraguay and Bolivia have been able to move seed into Brazil, and Uruguay has considerably reduced complications on moving rice seed into Brazil.

Finally I leave you with this thought. Whatever we do from here on, we need to do it faster; we need to do it better. Let's do it together.

DISCUSSION

MICHAEL LARINDE (FAO): I would just like to fill a gap. The harmonization work in SADEC, including common release of varieties, was also part of FAO activities working with Switzerland. We have a project that has been running for three years.

FIRMIN MIZAMBWA (AGRICULTURAL SEED AGENCY, UNITED REPUBLIC OF TANZANIA): I do agree with you on the benefits of the regional harmonization as well as on the mentioned increase in market size by opening doors where seed can move from one country to another. But I would like to use your experience to highlight any negative impact to this regional harmonization.

JOSEPH CORTES (SEED SCIENCE CENTER): In all honesty, I have not heard of any negative feedback on this. In other words: Has it caused any particular problems anywhere, are there people who might be in disagreement with the approach? I don't know. But personally I have not heard of any negative results because of the harmonization.

GRETCHEN RECTOR (SYNGENTA): I have a question about pest risk assessment and I am wondering if there is any framework for the facilitation of pest risk assessment with your phytosanitary standards.

JOSEPH CORTES (SEED SCIENCE CENTER): No, we do not get into any pest risk assessment. We have left that area to FAO and the IPPC to establish the pest risk assessment. What we did to be able to get to this final list of quarantined pests was to determine if the pest was present or not in the region. If it was not present, then it is not a quarantined pest. If it was already present, of course. Is it seed born? Is it a pathogen that is seed transmitted? No it isn't? Then out you go. And of course the economic value: Is there any economic value that is going to occur in a country because the particular pest is introduced into the country? A couple of times it was seen that it was of such low economic importance that it was left out. Those were the three bases that we used.

FRANCIS OBONGO (SEED TRADE ASSOCIATION OF KENYA): Mr. Cortes was talking about regional lists. I wanted to let the audience know that in East Africa, where this harmonization has been going on for quite some time, we do have a regional list. But there are now legal frameworks, like the seed law in Uganda and Tanzania, and the draft seed bill in Kenya that contain the provisions for regionalization of varieties. Once released in any two countries, they would be eligible to be listed as regional varieties. That has now been provided. Although no applicant has come forward, the legislation is in place.

JOSEPH CORTES (SEED SCIENCE CENTER): Thank you for that clarification. It is not only good for everyone to know, but I am very glad to hear that this is the direction that you have moved into.

JOHN KEDERA (CHAIR): You have raised during your presentation the issue of accreditation. We know in some forums that the term "accreditation" is not used because of what it implies. There is a preference for "authorization". Those are the things you might want to discuss. Regarding the question from Tanzania on regionalization; there has always been a fear that once you apply regional standards, the small domestic companies will be overrun by the bigger ones. And I think that's what he was implying by the matter of years. But we will leave that particular topic.

THE ROLE OF INTERNATIONAL CERTIFICATION IN FACILITATING TRADE AND MARKET DEVELOPMENTS

MICHAEL M. RYAN*

Introduction

The availability of a consistent supply of high-quality seed is the key to a competitive and productive agricultural crop sector. High agricultural productivity is essential to ensuring that adequate supplies of food are provided for the ever-growing world population. The ongoing efforts to develop new plant varieties and the distribution of these varieties to farmers across the globe are of paramount importance.

To ensure that adequate supplies of high-quality seed are available to agricultural producers in both the domestic and foreign markets requires a consistent checking of quality at all stages of the supply chain. The many stakeholders along the seed supply chain including breeders, producers, traders, regulators and farmers work together to ensure that quality standards are maintained and, indeed, enhanced. Close coordination of the work in breeding, testing and certification of seed is critical in facilitating trade of high-quality seed and in lowering non-tariff barriers.

With the advent of new technologies and the growth in demand, especially for hybrid seed, the global seed market has been growing rapidly in recent years. Today, the value of the seed market is estimated at about 37 billion US dollars, of which over 80 per cent is accounted for by North America, Europe and Asia. The global seed trade is dominated by large multinational companies. The international seed trade has grown substantially in recent years and is estimated at 6.4 billion US dollars for 2007. Growth in the international seed trade is being driven by several factors including the rapid decline in transport costs, differential production costs of high-yielding hybrid varieties, better communications and information on the availability of varieties, changing climatic conditions, counter-cyclical production, as well as a more reliable and supportive system of international certification.

In general, the seed trade is one of the most regulated sectors in all countries, with a plethora of seed laws, testing and certification procedures. The simplification and harmonization of testing and certification procedures helps to improve farmers' access to high-quality seed in all regions of the world.

In many countries seed certification is done at both national and international levels. The most widely used global certification systems are the OECD Schemes, while at the regional level other schemes are used, e.g. EU, AOSCA, etc. The main purpose of this paper is to discuss the role of international certification, primarily the OECD system, in facilitating international trade in seed.

The OECD

The Organisation for Economic Co-Operation and Development (OECD) is an intergovernmental Organisation, founded in 1961 and based in Paris. It is composed of 30 Member countries and works with over 70 developing and transitional economies. The Organisation provides a unique forum where governments can compare policy experiences, seek answers to common problems, identify good practices and coordinate domestic and international policies. It is a forum where peer pressure acts as an incentive to improve policy and which produces internationally agreed instruments, decisions and recommendations in areas where multilateral agreements are necessary for countries in a global economy.

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The OECD helps governments to foster prosperity and fight poverty through economic growth, financial stability, trade and investment, technology, innovation, entrepreneurship and development cooperation. Other aims include creating jobs, social equity and achieving effective governance. Analyses provided by the OECD Secretariat help the dialogue and exchange of information between OECD governments. The Secretariat collects data, monitors trends, analyses economic developments and researches evolving patterns in trade, agriculture, environment, technology, taxation, etc.

An Overview of the OECD Seed Certification Schemes

The OECD Seed Schemes provide an international framework for the certification of seed with the aim of facilitating the growth in trade of seed by reducing technical barriers. The Seed Schemes are a globally recognized system for the varietal certification of seed moving through international trade. The Schemes were established in 1958 in response to a combination of factors including the rapidly growing seed trade, the increase in regulatory requirements in some countries, the development of off-season production, the large breeding and production potential of exporting countries in North and South America and demand from the private seed industry.

The purpose of the OECD Seed Schemes is to encourage the use of “quality-guaranteed” seed in participating countries. The Schemes authorize the use of labels and certificates for seed produced and processed for international trade according to agreed principles. The OECD certification is applied to varieties satisfying DUS tests (Distinction, Uniformity and Stability), and the Schemes aim to ensure varietal identity and purity through seed multiplication, processing and labeling.

The OECD Seed Schemes facilitate the import and export of seed by the removal of technical trade barriers using worldwide recognized labels (seed “passport”). They also provide specifications for seed multiplication outside of the country, which is becoming an ever-increasing practice. In 2008, over 500 000 metric tons of seed were OECD-certified, traded and used by farmers. In addition, the main OECD principles can also be applied to seed that is used on the domestic market. In overall terms, the Schemes provide a consistent and operational legal framework at international level.

Trade in seed is subject to bilateral and/or multilateral agreements at local, regional, and international levels. As the first input in the cropping process, high-quality seed brings high genetic yield potential resulting in higher productivity and crop production. The body in charge of seed quality control in most countries is the National Designated Authority (NDA), which has responsibility to ensure the seed meets all the required standards for certification.

The OECD Seed Certification Schemes are based on two key criteria; varietal identity and varietal purity.

- ▶ Varietal identity: The identity of a variety is defined by the official description of its characteristics, resulting from a given genotype or combination of genotypes.
- ▶ Varietal purity: The purity of a variety is the proportion of plants or seeds within the population that conforms to the official description of the variety.

The Schemes are built on a number of fundamental principles. First, they include only those varieties which are officially recognized as distinct and having an acceptable value in at least one participating country. Second, all the certified seed produced must be related directly through one or more generations to authentic Basic Seed of the variety. In addition, satisfactory conditions for the production and processing of Basic and Certified Seed must be ensured and verified by field inspection and post-control tests. Third, post-control tests are conducted to ascertain that the Schemes are operating satisfactorily.

The number of countries participating in the OECD Seed Schemes continues to increase with new applicant countries requesting accession on an annual basis. Currently there are 57 countries participating in the OECD Seed Schemes (from Europe, North and South America, Africa, the Middle East, Asia and Oceania), and up to 10 observer organizations also regularly participate in the meetings.

There are seven distinct and independent Seed Schemes and admission to each Scheme is voluntary. The number of countries participating in each Scheme varies with the Grass and Legume Seed, Cereal Seed and Crucifer Seed and other Oil or Fibre Species Seed Schemes the most widely used.

- ▶ Grass and Legume Seed Scheme
- ▶ Cereal Seed Scheme
- ▶ Crucifer and other Oil or Fibre Species Seed
- ▶ Maize and Sorghum Seed
- ▶ Sugar Beet and Fodder Beet Seed
- ▶ Vegetable Seed
- ▶ Seed of Subterranean Clover and Similar Species

The success of any international certification scheme depends upon close cooperation between maintainers, seed producers, traders and the NDA in participating countries. The evolution and adaptation of the system depends crucially on the inputs from the NDAs. The frequent meetings between authorities of participating countries allow for the exchange of information, discussion of concerns, the preparation of new Rules and the updating of the Schemes. The NDAs are responsible in Member countries for the implementation of the Schemes.

The European Commission has a special recognized status in the OECD. International organizations, whether governmental or representing industry and farmers, participate as observers in the OECD meetings. UPOV, ISTA and ISF are involved and are very active in the OECD's work. There is long-standing cooperation with FAO and regional organizations such as AOSCA, WANA Seed Network, and also with seed industry networks such as APSA (Asia-Pacific Seed Association), AFSTA (African Seed Trade Association), EESNET (Eastern European Seed Network), ESA (European Seed Association), etc.

Implementation of the Schemes

A number of basic documents are required for the implementation of the Schemes in Member countries including the Rules of the Schemes, List of Varieties and, the Guidelines for Control Plot Tests and Field Inspection of Seed Crops.

The Rules of the Schemes contain all the general and legal texts, standards and technical requirements for each of the seven Schemes, as well as the prescription for certificates and labels. The Rules are discussed and updated regularly in line with the ongoing changes in the regulatory, trade and policy environment.

The OECD List of Varieties eligible for OECD certification includes varieties which are officially recognized as distinct and having an acceptable value at least in one country. It contains most of the internationally traded varieties, the number of which has grown steadily over the last 30 years. The number of listed varieties now exceeds 42,000 varieties and 190 species. In recent years, the largest increase has been for maize and oilseed rape; sunflower, rice, soybean, and forage species. A new updated List of Varieties is published in January and July each year.

In addition to the Rules, the Guidelines for Control Plot Tests and Field Inspection of Seed Crops describe methods that can be used or adapted where local conditions make this necessary, by participating countries.

There are a number of key technical requirements, methods and standards along the seed multiplication chain that all participating countries should adopt in the implementation of the Schemes.

Seed categories: The following categories are recognized, each corresponding to a well-specified generation number and associated technical conditions: Pre-Basic Seed, Basic Seed, and Certified Seed. Each category has its own specific colored label.

Trueness to type (varietal identity): Varieties are maintained true to themselves (to the description of the varieties) throughout successive seed multiplication.

Minimum varietal purity standards: Seed lots must satisfy minimum levels for varietal purity to be preserved. These requirements are achieved by way of previous cropping conditions, isolation distances, etc. Field inspections are made for checking these elements and standards.

Multiplication in another country: Specific provisions allow for the exchange of relevant information. When seed multiplication takes place outside the country of registration of a variety and the NDA has permitted such a commercial multiplication, the maintainer should be consulted and good contact should be established between the NDAs of the countries concerned.

Post-control plots: The identity and varietal purity of the seed is randomly checked each year in official post-control fields set up by the NDA. In some cases, chemotaxonomic tests are also used.

Samples and laboratory analysis: Each lot of OECD-certified seed is subject to official laboratory tests (analytical purity, germination, moisture content, etc). OECD Certification uses ISTA or equivalent sampling and testing methods.

Requirements for joining the OECD Seed Schemes

Any country wishing to join the OECD Seed Schemes must follow the procedures as set out in the OECD Rules and should satisfy the following criteria.

- ▶ The opportunity to develop exports and/or imports of certified seed.
- ▶ A national seed law which provides the legal framework for variety registration and seed certification.
- ▶ A national list of varieties.
- ▶ An efficient domestic certification system, with adequate equipment and qualified staff for field inspection, seed sampling and labeling.
- ▶ An efficient laboratory for seed analysis according to ISTA Rules or equivalent.
- ▶ A system of post-controls to check the varietal purity of the certified seed.

Some Recent Developments in the OECD Schemes

The Schemes continue to evolve and develop to meet the challenges of a changing trade, regulatory and policy environment in Member countries, as well as the challenges posed by the participation of new Member countries from different regions of the world. Some of the more recent developments are outlined below:

- ▶ India and Moldova became full members of the Schemes in 2009.
- ▶ Three new species were recently added to the Schemes: *Nicotiana tabacum*, *Trifolium spumosum* and *Trifolium dasyurum*.
- ▶ The Netherlands extended its participation to the Vegetable Seed Scheme and Kyrgyzstan to the Grass and Legume Seed Scheme.
- ▶ The maximum seed lot size has been revised upwards to 30 metric tons.
- ▶ Two technical provisions of the post-control rules were amended in line with the needs of Member countries.
- ▶ Other technical amendments related to the revision of the isolation distance for cotton seed.
- ▶ The definitions of varietal purity and varietal identity were added to the Rules of the Schemes.
- ▶ The Strategic Plan for the Schemes was finalized. The Plan identifies several priority areas for future work within the Schemes. The prioritization exercise will ensure that the Schemes will continue to add value to the work of international certification and will remain highly relevant to the needs of Member countries.

Benefits of International Seed Certification

The harmonization of certification procedures at international level has made a significant contribution to developing the global seed trade. The benefits arising from the facilitation of trade in seeds and the improvement in market access are numerous and can be summarized as follows:

- ▶ A lowering of the technical barriers to trade (TBT).
- ▶ Improved transparency for traders and stakeholders.
- ▶ A reduction in transaction costs.
- ▶ The use of worldwide recognized official seed labels and certificates facilitate the exchange of technical information on seed.
- ▶ Encourages the development of seed production in other regions and countries.
- ▶ Contributes to the elaboration of international rules for seed certification.
- ▶ Promotes collaboration between the public and private sectors.
- ▶ Shares experiences and information on emerging issues and concerns in the seed sector.

A large number of countries are already participants in the OECD Seed Schemes and this number is likely to increase as more countries are entering international markets, and seed “consumers” are becoming more demanding with respect to supply consistency, quality and safety.

Good cooperation between countries and all stakeholders including international organizations is a response to the need to develop a market-responsive regulatory approach. Every country will continue to be faced with a different legal system and institutional structure and, yet, must compete on the global market.

Conclusions

The rapid growth in the volume of international trade of seeds has given rise to many challenges, not least of which is the need to harmonize certification procedures and to adopt reliable and enforceable standards. The OECD Seed Certification System is the most widely used global certification system for the export and import of high-quality seed.

The ongoing development and release of new plant varieties and the trend toward the multiplication of seed in third countries increase the complexity of the production and distribution systems. Moreover, increasing cooperation between the public and private sectors is paramount to ensuring that the benefits arising from the use of new varieties are shared between the different shareholders in the system.

The adoption of international certification standards has encouraged the growth in the seed trade by reducing technical barriers to trade, increasing transparency, lowering transaction costs and increasing access by farmers in all regions of the world to high-quality seed.

DISCUSSION

FRANÇOIS BURGAUD (GNIS, FRANCE): I would like to know if you have already had any discussions at the OECD level, about the possibility of a company in a country which is not in the OECD Schemes, to ask another country to send someone to do the work, so that the company is able to export the seeds. Because in many developing countries, the governments don't want to do the job and pay for joining the OECD Seed Schemes. But in those countries there are some companies with the opportunity to produce seeds especially in counter-seasons. So I would like to know if you might open this door in the future.

MICHAEL RYAN (OECD): This is a question that has been discussed for quite a while in the OECD. There are two parts to the question. One part relates to the multiplication abroad issue, and we have had a technical group working on this issue for some time. Although it's a very complex issue, I think we are making good progress on that. And we hope that the next meeting of our technical working group will be able to report some positive results. The other element you mentioned was related to seed companies working in countries that are not members of the Schemes. As OECD is an inter-governmental organization, we primarily work with the governments of the countries involved in the particular project. However seed companies and a range of other companies are represented in OECD through the BIAC (The Business and Industry Advisory Committee), and some of the seed companies here today are part of that committee. This is a committee that represents industry and they consult regularly with the different OECD committees providing input and advice from the industry. We also have other groupings such as the TUAC and also the IFAP from the farmer's side. The issue of seed going to other countries is also in the process of discussion, but we haven't come to a clear conclusion yet. Once we do come to a conclusion or a consensus on the issue, then there will be a modification in the Schemes. So, these discussions are ongoing but they have not yet come to a conclusive stage.

PATRICK NGWEDIAGI (MINISTRY OF AGRICULTURE, UNITED REPUBLIC OF TANZANIA): In his presentation Mr. Ryan said that one of the conditions for a country to participate or be a member of the Schemes is to have a satisfactory laboratory. I just wanted to know what the conditions for having a satisfactory laboratory are. Whether they are different from what is required by the ISTA quality assurance system and whether you have a separate requirement.

MICHAEL RYAN (OECD): As specified in the rules of the OECD Schemes, it is an ISTA-accredited or equivalent laboratory that is required in terms of the standard.

NARAYAN DHONDI JAMBHALE (INDIAN COUNCIL OF AGRICULTURAL RESEARCH): You said there are 198 species with the 40,000 varieties identified earlier, and then in 2009, 190 species are mentioned and 42,000 varieties. What are the criteria for the selection of these varieties?

MICHAEL RYAN (OECD): The 2009 list of varieties was an update on the earlier one. It is approximate; just over 40,000 varieties. Concerning the addition of new species, the request must be presented to the Annual Meeting of the Schemes. Once approved, the new species are added to the list. For varieties, the criterion is that they must meet a range of descriptive requirements as set out in the Rules and Regulations of the Schemes. These requirements are checked and if, following the check, all the information provided is satisfactory, then the variety is listed on the OECD list. This work is not done within the Secretariat, but it is done by the OECD Coordinating Centre, which at present is NIAB, in Cambridge, UK. They provide the technical input by evaluating the technical content in relation to the criteria for including new varieties on the OECD list.

JOHN KEDERA (CHAIR): We will close the discussion on that. I think there are the two things we need, cost effective regulations and they must be simplified to meet the requirements.

PHYTOSANITARY MEASURES AND THE INTERNATIONAL SEED TRADE

Mr. JEFFREY JONES*

Summary

The international movement of seeds as a commodity for seeds for planting or intended for planting supports food production and hunger alleviation globally. Seeds are considered high-risk material in international trade, providing a ready pathway for movement of pests, especially seed-borne pathogens. The purpose of the International Plant Protection Convention (IPPC) is to prevent the spread and introduction of pests of plants and plant products and to promote appropriate measures for their control. The International Standards for Phytosanitary Measures (ISPMs) published by the IPPC provide guidance regarding phytosanitary measures and their application to the international seed trade.

The Role of the IPPC in Seed Health

The IPPC is a multilateral treaty for international cooperation in plant protection, promoting harmonization of phytosanitary measures in commerce and the environment and is the international phytosanitary standard-setting organization recognized in the World Trade Organization Agreement on the Application of Sanitary and Phytosanitary Measures (WTO-SPS Agreement). Its purpose is to prevent the spread and introduction of pests of plants and plant products, while promoting measures for their control.

The international standards, guidelines and recommendations regarding phytosanitary measures uphold key principles of the SPS Agreement and, for example, encourage Contracting Parties to institute only measures that are:

- ▶ technically justified and consistent with the pest risk;
- ▶ non-discriminatory: measures applied to imported seeds should be no more stringent than those locally produced and countries with the same phytosanitary status should be treated equally;
- ▶ least restrictive, with minimum impediment to international movement of plants/seeds;
- ▶ mindful of equivalence of measures (for a specified risk, different phytosanitary measures to achieve a Contracting Party's appropriate level of protection).

Consistent with the risk-related application of measures, the IPPC has defined pests that should be regulated, namely:

Quarantine Pest (QP): A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled [IPPC, 1997].

Regulated Non-Quarantine Pest (RNQP): A non-quarantine pest whose presence in plants for planting affects the intended use of those plants with an economically unacceptable impact and which is therefore regulated within the territory of the importing Contracting Party [IPPC, 1997].

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Phytosanitary Measures applied to Movement of Seed

A phytosanitary measure is defined as any legislation, regulation or official procedure having the purpose to prevent the introduction and/or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests (ISPM No. 5). In that regard, the IPPC has the responsibility to protect plant resources while facilitating safe movement of plants and plant products internationally.

Seeds are defined as a commodity class for seeds for planting or intended for planting and not for consumption or processing (ISPM No. 5). International movement of seeds supports food production and hunger alleviation globally. The importance of the international seed trade takes on greater significance in the face of severe food shortages and higher food prices, deforestation and population increase. Food losses globally due to pests are often estimated at between 25 to 40 per cent (Pimentel, 1997; Oerke and Dehne, 2004) and seeds in international trade provide a ready pathway for movement of pests, especially seed-borne pathogens. Against these odds, the seed industry shares the responsibility to ensure safe movement of healthy seeds internationally.

Phytosanitary certification of seeds for export and compliant with importing country requirements remains a core obligation of Contracting Parties to the IPPC. Importing countries are obligated to require the application of measures that are consistent with the principles outlined above. Risk analysis provides the basis for setting requirements for the import of seeds. Risk analysis for quarantine pests involves evaluating biological or other scientific and economic evidence to determine whether a pest should be regulated and the strength of any phytosanitary measure to be taken against it. Risk analysis for RNQPs is applied only for seeds or plants for planting, and recognizes appropriate pest tolerance levels based on economic impacts on those plants. Zero tolerance is not likely to be a general requirement.

Many of the ISPMs provide for regulation of seeds (planting material), for example:

- ISPMs Nos. 7 and 12 – Export certification and phytosanitary certificate
- ISPM No 11 – Pest risk analysis for quarantine pests, including analysis of environmental risks and living modified organisms
- ISPM No 19 – Guidelines on lists of regulated pests
- ISPM No 21 – Pest risk analysis for regulated non-quarantine pests
- ISPM No 23 – Guidelines for Inspection
- ISPM No 28 – Phytosanitary treatments for regulated pests
- ISPM No 31 – Methodologies for sampling of consignments
- ISPM No 32 – Categorization of commodities according to their pest risk

Other relevant ISPMs in various stages of development or for which a specification (S) has already been developed include:

- S 34: Pest risk management for plants for planting in international trade
- S 21: Guidelines for regulating potato micro-propagation material and mini-tubers in international trade
- S 47: Reducing pest risks in the international movement of seeds of forest tree species
- S 42: Pre-clearance for regulated articles

Draft ISPM: Design and operation of post-entry quarantine stations

Seeds for planting are usually classified as high phytosanitary risk material and certification of seeds may require the application of a measure or a combination of measures to the crop, the production area, the commodity during transit or at post entry. Common conditions or requirements apply in the application of phytosanitary measures. For example:

An Import Permit: An official document authorizing importation of a commodity in accordance with specified phytosanitary import requirements. This is generally required for importation of seeds by NPPOs.

Certification Schemes: Normally registered with and approved or certified by NPPO with trace-back and audit systems established. Management options may consist of a combination of two or more measures. These options may be applied to:

- ▶ area of production (treatment, area of low-pest prevalence, area of pest freedom, monitoring surveys, etc);
- ▶ place or site of production (isolation in space or time, pest-free place, IPM);
- ▶ parent stock (e.g. treatment, resistant varieties, selection of propagating material);
- ▶ consignment of seeds (e.g. treatment, preparation and handling, sorting).

Pre-inspection/Pre-clearance: These strategies are used to facilitate trade logistics at the request of the exporting country; Contracting Parties may bilaterally negotiate an agreement for allowing clearance in the country of origin by the NPPO of the country of destination. Joint auditing of the export certification system to facilitate new trade may be negotiated.

Select Entry Ports: Based on but not limited to the following criteria:

- ▶ skilled staff with competence in compliance checking;
- ▶ inspection and testing capability/facilities;
- ▶ disinfestation facilities;
- ▶ post-entry quarantine facilities.

Post Entry Quarantine (PEQ): May include different levels of security, for example, field site, screen house, glasshouse and/or laboratory. Location, physical and operational requirements, systems for diagnosis and treatment of quarantine pests and auditing of the station should be considered in the establishment of PEQ stations. The type of PEQ station to be used should be determined by the type of imported seeds and associated quarantine pests.

Recommendations

Considering the importance of a safe international seed trade to food production, it is important that partners, where appropriate,

1) Understand an importing country's requirements

Exporting partners should respect and fully understand phytosanitary regulations of importing countries. Non-compliant consignments may increase the risk of pest introduction and spread. Credible certification of seeds promotes market access and maintenance.

2) Use of ISPMs

ISPMs as minimum requirements provide guidance and recommendations that are applicable to the seed trade; for example, on inspection methodology, pest risk analysis and risk management, recognition of pest-free areas, phytosanitary certification. Trade partners should study the provisions of the ISPMs and apply them where appropriate in order to avoid unnecessary trade conflict.

3) Enhance cooperation

Establish strong linkages between seed associations, NPPOs and the IPPC in order to promote greater understanding, information-sharing and consistent action on issues regarding safe trade in seeds.

4) Develop national pest lists

NPPOs should strive to have national surveillance and national pest listing programs embedded in policy, recognizing that these programs underpin technically sound decision-making in the application of phytosanitary measures.

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DISCUSSION

GARLICH VON ESSEN (ESA): You mentioned quite a number of ISPMs that also deal with seed, but do not deal with seed specifically. And you also said that seed should be looked at even in a more stringent manner because it is a high-risk material. Well I think there is also a possibility to look at it from another angle, because it is a material that is already very regulated, very closely watched, by the people who own the seed, because it's so valuable. So I think people who trade in seed usually know very well what they do and how they do it and how to make sure that they have a high-quality seed. But would it be an idea also for a better spread of information to think about a specific ISPM for seed only? Pooling all the information that you have in the different parts of other ISPMs make it more logical, maybe more accessible for all the IPPC members. Could that be an idea or is it too complicated?

JEFFREY JONES (IPPC): I think that is a good question in the context of what we are discussing. However you need to understand the process of procedures to which ISPMs are converted. If you feel that it is necessary, or there is an information gap, and that you think the IPPC could consider a topic specifically on seed, I think, through the process of standard setting, you can give to us that sort of topic which could be considered.

MICHAEL MUSCHIK (ISTA): I have a question because we want to strengthen the collaboration between ISTA and IPPC. I see moderate progress, so I wanted to ask you what your ideas are for strengthening collaboration in the future. I think that from the ISTA point of view, there is a lot we can offer in regards to sampling, in regards to identifying wheat seeds, in having methodologies for seed testing. Do you have any proposals on how we can make quicker and faster progress there?

JEFFREY JONES (IPPC): The Chairman may correct me if I am wrong, but is ISTA actually invited to our CPM meetings?

JOHN KEDERA (CHAIR): Yes, they have been to all CPM meetings and the element of collaboration has come up. There is a proposal that is on the table, but it hasn't been progressed. And I think that could come in the general discussion if it has progressed to the next level, rather than you getting into it. I hope I have answered your question because I am aware of the issue you raised. It is something that can be pursued.

AAD VAN ELSSEN (PLANTUM, THE NETHERLANDS): I have a few questions. I would like to talk about shared responsibility. It is something that really appeals to the private sector, and we have heard a lot about public-private partnership, but I must say that in the field of phytosanitary regulation that is still far away. For example, if you see the example given by the first speaker from Iowa State; in several regions it's possible for companies to do their own phytosanitary inspection, even for quarantine pests. Now in the EU that's not possible. My first question would be: What is the role of IPPC there, since you are talking about harmonization? This is something the seed sector and the plant sector really want; that companies take responsibility for their own product under some sort of accreditation. Now the same thing applies a bit to the whole question of PRAs. The PRAs sometimes seem to be the new trade barrier. Every country that has the right to ask for PRAs can ask for them, and although you claim that they should always be technically justified, they are not always technically justified. There is no mechanism to control that. So one of the things that the IPPC should set up is some sort of dispute settlement, in order for the companies or trade organizations to have at least a discussion when they think a country is technically unjustified to make a request for a PRA. The last thing you said was that there should be linkage between seed associations and PPOs and the IPPC. Now at national level, sometimes that works. But I think that also the IPPC should get into the linkage and at least allow the ISF and ESA or whatever organization to be an official observer at their meetings. So far, we have never been allowed. I think that is a step that the IPPC could take very quickly with, for example, UPOV to be official observer. Because we have something to contribute, and I think that should be more valued than it has been done until today.

JOHN KEDERA (CHAIR): I would first of all like to ask you to check the facts on the statements just issued. In terms of what happens in countries, I think if the people responsible for seed certification are separate from those dealing with the phytosanitary issues, you will always end up with a territorial competition. And this is a global issue that is actually being looked at, because there is also this sort of competition. In terms of the ISF being an observer sometimes at the IPPC, I think I have seen them at the CPM. And in the CPM, there is a dispute resolution mechanism which nobody yet has applied to use. So I would like you to check the facts. But I take your questions very positively because we need to get information out to all participants in order to accurately facilitate a good regulatory framework, because you are talking about a trend, and market development. We will get back to this question during the general discussion.

HARMONIZATION OF SEED TESTING FOR THE FACILITATION OF TRADE

Mr. JOËL LÉCHAPPÉ*

Introduction: Methods for Assessing Seed Quality: Measurement Tool or Factor for Competition?

In agriculture, and more generally in plant biology, where biodiversity is a fundamental element of development, talk of harmonization may seem a paradox. So why is it so important to harmonize and standardize the methods of quality control of seed? Would it not be simpler and less expensive to let the competition follow its own paths?

In terms of quality seeds, what is expected from farmers, the seed trade and regulatory bodies is seed that produces a healthy crop at a fair price.

The value of the global seed market is modest (37 billion US dollars), but this trade has an important role in the overall seed industry. In a competitive market it must be possible for the buyer or user to compare the quality of available seeds. To facilitate this, seed quality control must deliver in good time essential information on seed lots. Methods of assessing the quality of seed should therefore be regarded more as measuring tools for industry players, rather than as elements of competition. Competition is related to the quality of seed not to the method of quality measurement.

Broadly speaking, and in all industrial, scientific and commercial areas the initial establishment of trade is based on certain common factors:

- methods of measurement standards;
- standard units (metric, decimal, mass in kg, watt, degrees, etc.);
- common communication tools for centuries using a common language (scientific Greek, Latin, French, German, and English). To these we can now add modern tools of communication (telephony, Internet, etc.).

The trade of seeds is no exception. That is how the demand from the trade for an internationally accepted test report as a communication tool on seed quality has been the starting point for harmonization of seed-testing methods. Therefore, to answer this demand international seed organizations aim to develop and harmonize methods for analysis of seed quality. Among them, I allude to the ISTA (International Seed Testing Association) and AOSA (Association of Official Seed Analysts in North America). The ISTA, which is the subject of this presentation, has since 1931 proposed standard tools for measuring seed quality supplemented by an international means of communication.

In this presentation we will first describe the harmonized approaches at the international level that ISTA has made in terms of standardization of analysis methodology and the communication of results. In the second part, we examine the benefits of harmonized analytical methods to major clients and regulatory bodies and the contribution of such methods to the development of regional and international seed production. The presentation concludes with a reflection on the future of method standardization.

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1. The Harmonization of ISTA Testing Methods for Seed Testing Quality: A Process constantly evolving with its Environment.

1.1 The Main Methods of testing the Quality of Seeds and their Applications

The pillars of seed quality control tests used regularly for trade are:

- ▶ Analytical purity, other seed determination, germination and moisture content tests. The total number of these tests can be estimated at several hundred thousand per year worldwide.
- ▶ Since the 1960s, diagnostic seed-health tests and more recently tests for the detection of GMOs have expanded considerably.
- ▶ Other laboratory tests, such as vigor, tetrazolium viability and varietal purity, are used less for the trade of seed. They are mainly developed in order to provide information on the performance of seed lots or on their conservation and storage (Fig. 1).

Fig. 1 Standard Methods for Evaluation of Seed Quality (sampling a seed lot, purity testing, germination testing, seed-health testing e.g. an ELISA assay)



1.2. Identifying Methods needed by the Seed Sector

The ISTA has an international reputation: its members represent 74 countries and are drawn from analytical or research laboratories in the public sector as well as from the seed industry. This position at the interface between research, industry and regulation greatly facilitates the identification of needs for new methods or changes in existing methods. In particular, members of the Association are at the root of many projects involving the development of new validated methods through ISTA technical committees. In addition, the strong participation of government representatives (Table 1), as members appointed by the designated authorities, and close contacts with international organizations (such as FAO and the OECD) and organizations in specific regions of the world (such as African or Asian bodies) play a major role in the strategic development of ISTA and its methods. The emergence of new regulations, such as the control of GMOs, phytosanitary requirements and health surveillance or the reduced use of pesticides, are carefully considered and taken into account.

The industry and its representatives at the global level (ISF) or at regional levels demand analytical methods to meet trade requirements and to control risks related to quality. Here the need for detection methods for GMOs is in everyone's mind as is the sanitary quality of seeds, especially among vegetable species where it is a major criterion. The partnership built between the ISTA and the ISHI/ISF (International Seed Health Initiative) is based on their complementary skill sets. The ISHI identifies the major pathogens of interest to industry and is developing protocols in partnership with the ISTA Seed Health Committee.

Thus, the methods in the ISTA rules are there to either meet regulatory needs (e.g. purity, germination, phytosanitary) or to satisfy technical and commercial evaluation objectives regarding the potential of seeds (e.g. vigor, state of health). They are a tool whose use is completely open to all users.

Table 1 Regional Distribution and Status of ISTA Member Laboratories

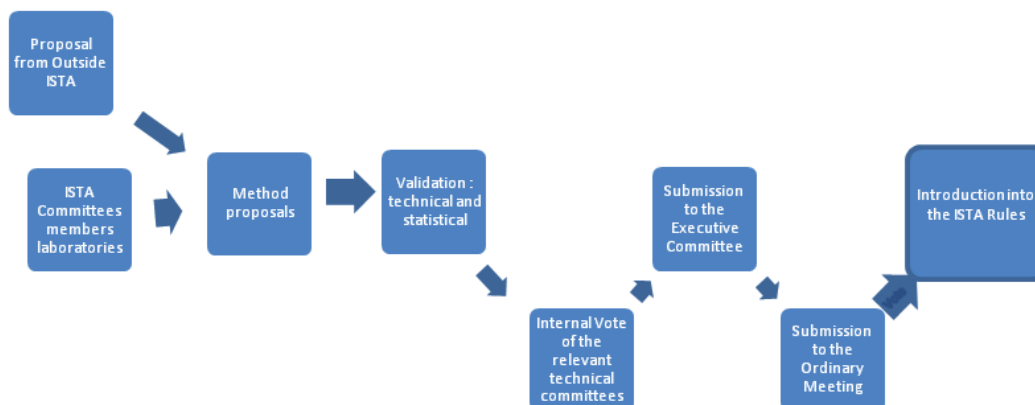
	Total	Private independent	Seed companies	Governmental
	2008	2008	2008	2008
Africa	16	0	3	13
Asia & Pacific	51	4	14	33
East Europe	33	0	5	28
West Europe	57	4	13	40
North America	12	5	2	5
South America	13	0	2	11
Total	182	13	39	130
2008: 182 member laboratories worldwide				

1.3. The Method Validation Program: A Guarantee for Transparency, Relevance and Traceability

To meet the expectations of the trade, methods of quality evaluation must be robust, repeatable and reliable whatever the region where the analysis is made. Ab initio methods introduced into the ISTA Rules had to undergo a validation process, admirably described in a recent article by Steiner et al., 2008: "ISTA Method Validation 2007: A Historical Retrospect". Seed Testing International. This process has been formalised into a series of steps (Fig. 2) described in the ISTA Method Validation for Seed Testing 2006, published on the ISTA website <http://www.seedtest.org/upload/cms/user/ISTAMethodValidationforSeedTesting-V1.01.pdf>.

The ISTA is completely open to all proposals for new methods which may be proposed by an ISTA technical committee, by a stakeholder or by someone outside ISTA. Proposals are developed by the technical committees who provide scientific and statistical evaluation. This is followed by a review by the Executive Committee of the competence of the method in terms of the objectives and policies of the association. The proposal is then submitted to a vote by the General Assembly, composed of members appointed by governments. Finally, new methods are included in the ISTA Rules which are updated annually. The total duration of the validation process for a new method varies from one to three years depending on the complexity of the study. Validation studies are published on the website of the Association, which ensures transparency, traceability and the scientific robustness of new methods.

Fig. 2 The ISTA Procedure for Validation of Seed Testing Methods



1.4. Communicating the Results in a Standard and Comprehensive Way: the Orange and Blue International Certificates

The ease of reading and understanding the results of analyses is an important element in communicating the results of these analyses for the trade of seed. This is why ISTA Rules give detailed prescriptions on the presentation of test results (units, precision = number of decimal places, methods) as this helps improve interpretation. However, depending on their use, the results can be published on different types of test report.

- ▶ For local commerce they can be on a test report that is particular to the laboratory that conducted the test.
- ▶ For domestic trade they can be on national or certification test reports, often with the logo of the certification authority and/or national accreditation body (ISO 17025).
- ▶ At the international level they are generally on ISTA certificates (orange for lots of seed, or blue for seed samples) and these certificates are used for import/export transactions.

ISTA International Certificates with their ISTA logo guarantee the identity of the seed lot with a single reference; the traceability of the analysis; the competence of the laboratory that made the analysis; the use of referenced methods and standard units; the use of standard reporting languages (English, Latin and others). Today, the ISTA Orange International Certificate (OIC) is widely used (Table 2) for international trade. This is the identity card of seed lots, the pass at many borders and the technical and administrative requirement of many contracts. The OIC is at the top of a pyramid consisting of a set of processes and rules that guarantee the value of the results and form the link between these and a seed lot consignment.

Table 2. Use of The International ISTA Orange Certificate for International Trade (Fig: Sales of ISTA Certificates from 2001 to 2008 "Activity Report of the ISTA Committees, 2008", 30-87)

Type of certificate	2001	2002	2003	2004	2005	2006	2007	2008
Orange	98 100	95 700	81 950	123 880	70 300	116 000	124 270	110 517
Blue	3 700	6 070	6 950	6 060	2 412	5 090	6 800	6 050
Total	101 800	101 770	88 900	129 940	72 712	121 090	131 070	116 567

1.5. A Quality System to ensure Uniform Application of Methods: The Accreditation of Laboratories

To strengthen the system of validated standard methods and standard methods of communicating results, a process to ensure the correct application of methods by all laboratory users should be in place. In 1995, ISTA established a program of laboratory accreditation for seed testing (see the ISTA website for the latest version of the ISTA Laboratory Accreditation Standard) http://www.seedtest.org/upload/cms/user/ISTALaboratoryAccreditationStandard_Version5.pdf).

To be an accredited candidate, laboratories must establish a quality assurance system, pass audits and obtain satisfactory results in the ISTA proficiency test program. Compared with standards such as ISO 17025, the ISTA standard is designed specifically for seed laboratories carrying out seed quality tests in accordance with the ISTA Rules. The opening of this program to company as well as government laboratories increases the diversity of contributions to ISTA, integrates the needs of industry and facilitates the development of ISTA methods within companies.

Accreditation ensures the competence of laboratories, their independence, impartiality and operation according to a common standard, regardless of the region of the world in which they are based (Fig. 3). The requirements are common to all laboratories but there is flexibility and diversity in the

means used by laboratories to meet requirements. The methods of the basic tests such as purity or germination rely mainly on human and technical solutions. The solutions can be tailored to meet the needs of the particular situations of individual laboratories. For example, the control of germination substrates makes use of conductivity and PH meters, but if these are not available, an unsophisticated suitability test can be carried out by germinating indicator species on the substrates. Therefore, control procedures of direct relevance are available to laboratories whatever their level of access to scientific equipment.

The map (Fig. 4) shows the distribution of accredited laboratories. Irrespective of the country and the techniques they use to test in accordance with ISTA rules, these accredited laboratories can analyse seed quality with the same level of reliability. They can apply their techniques to the analysis of seed lots for domestic purposes or for import and export purposes. They are, in effect, autonomous and masters of their own trade.

Fig. 3 Regional Distribution of the 106 ISTA-accredited Laboratories (as of December 2008)
(Activity report of the ISTA committees, 2008)

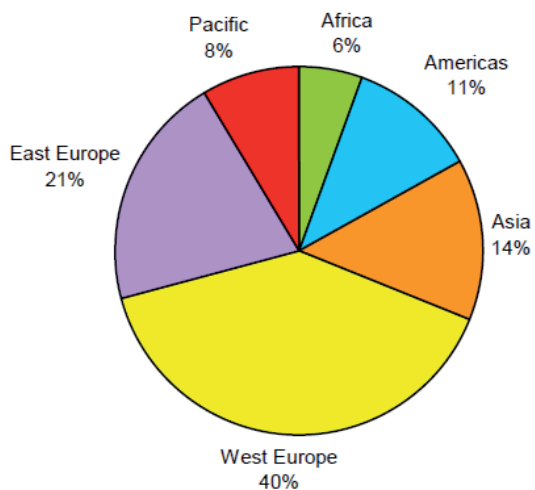
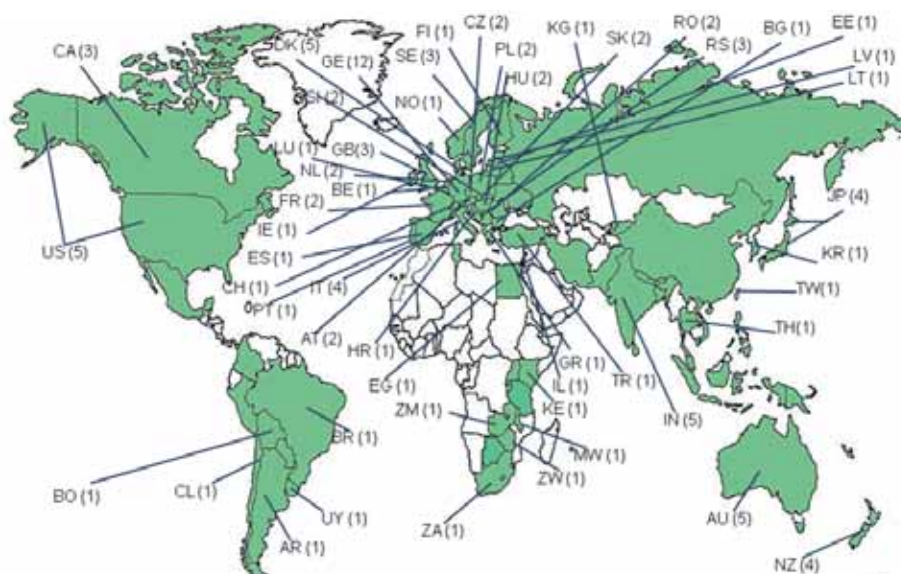


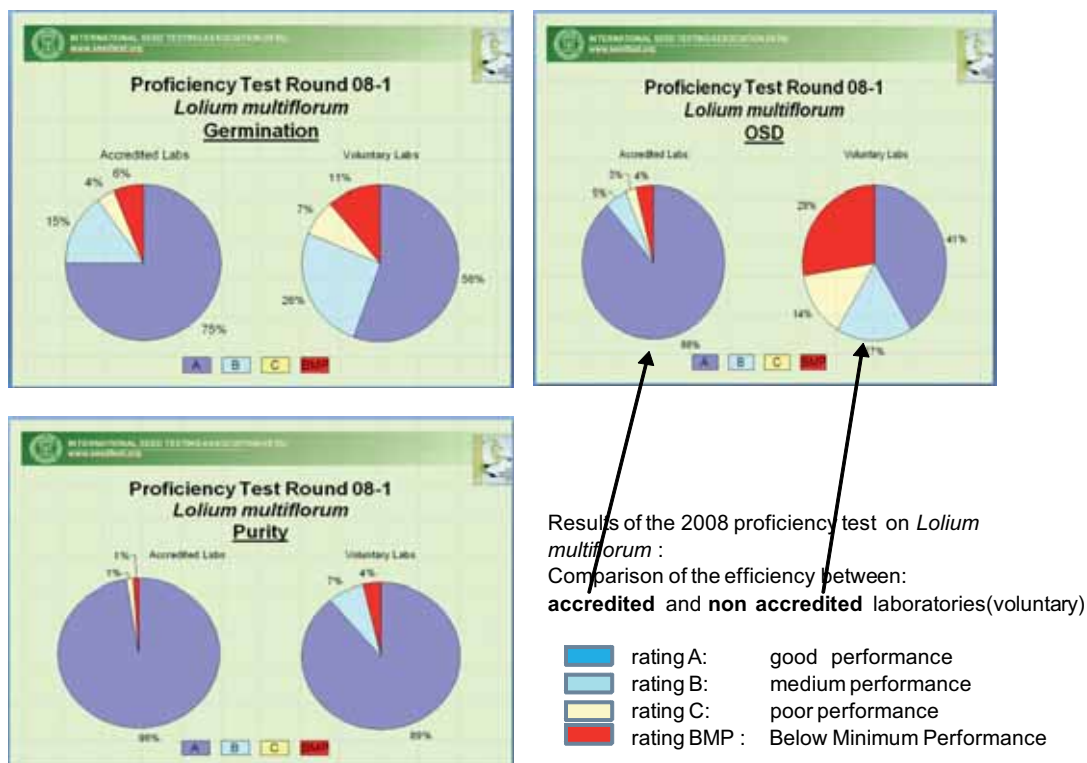
Fig. 4 ISTA-accredited Laboratories Worldwide



1.6. Verifying the Competence of Laboratories through a Global Proficiency Test Program

The requirement of resources and skills guaranteed by the accreditation standard is complemented through the verification of the reliability of results with an extensive proficiency test program. All areas of testing are covered: purity, germination, moisture content, tetrazolium, vigor, seed health and GMO testing. The proficiency tests guarantee the equivalence of the quality of measurements made with the same methods, the same skills and with the results presented in the same way. The frequency of proficiency testing ensures that laboratories use updated methods in the ISTA Rules for their analyses. The Minutes of the Committee of ISTA Proficiency Tests (Muller, 2008), clearly demonstrate that accredited laboratories achieve the greatest consistency of results in comparison to volunteer laboratories that have not yet achieved accreditation. The pie charts in Fig. 5 clearly demonstrate the benefits of accreditation even when laboratories are using the same standardised methods. Accreditation ensures that laboratory assistants are trained and qualified to apply the methodology to obtain a meaningful assessment of quality.

Fig. 5 Results of the 2008 Proficiency Test on *Lolium multiflorum*: Comparison of the Efficiency between Accredited Laboratories and Non-accredited Laboratories



Source: (Muller, 2008, ISTA Activity report 2008, Proficiency Test Committee)

1.7. Training completes the Approach and Assures Knowledge of Modern Methods

Training is an essential component in the mastery of methods of analysis. Workshops, meetings and the use of ISTA publications in seed analyst training are important. Training carried out in different regions in partnership with other international organisations, such as FAO, have a double benefit in that as well as enhancing the application of existing methods, it is possible to gather information on the needs and requirements for method development in different regions of the world.

1.8. Managing Disputes between Laboratories

The whole approach described minimizes differences in evaluating the quality of seed lots by accredited laboratories and this in turn minimises the possibility of disputes. Where differences occur, a process managed by the ISTA Secretariat (ISTA Rules 2009, Chapter 1) makes it possible to quickly re-

solve matters (Fig. 6). Most disputes arise as a result of non-accredited laboratories approximately applying the ISTA Rules. In such cases the damage can be substantial and the resolution procedures lengthy.

Fig. 6 Disputed Results, A Simple and Efficient Procedure to reduce the Risks of Litigation



2. Harmonized Testing Methods and Validation, a Tool for the Production and Trade of Seeds

2.1. Who are the Users of Standard Methods?

In all the presentations at this Conference, we are constantly reminded that seeds are the basis for food and industrial development. At the end of the 19th and early 20th centuries, it was customary to require a “sound and fair market” for seed (*Semences saines, loyales et marchandes*, (Schribaux, 1884-1951)). Since the first edition of the ISTA Rules and the advent of international certificates in 1931, the evaluation of seed quality based on internationally recognized methods has spread gradually. Their use by interested parties varies according to their needs.

- ▶ The primary users are the ISTA-accredited laboratories and members of ISTA. These are official laboratories, seed company laboratories or private laboratories. Many other laboratories are not members but use the ISTA Rules for evaluating seed quality. These include company laboratories that test seed quality before marketing or for certification using the same methods that are used for official controls. Others who make similar use of the ISTA Rules are laboratories working for agricultural cooperatives or unions and private independent laboratories for whom seed testing is a business. Research laboratories use ISTA Rules for testing new methods in comparison with standard methods. In all cases, tests are conducted to answer questions from customers or regulatory authorities regarding licensing, certification, import/export and trade in general.
- ▶ Governments, particularly those who adhere to the OECD system of certification, have established systems of seed certification in support of their national regulations based on ISTA or AOSA methods. This is also the case in the EU where seed marketing directives require the use of international seed-testing rules. ISTA is very careful to ensure that changes to the rules of analysis take account of the expectations and constraints of these users. The addition of new methods, based on technical validation and a vote on their inclusion by designated members representing governments, according to the ISTA Constitution, gives an important guarantee to this stakeholder group.
- ▶ National seed industries include the use of ISTA methods in contractual agreements covering the production and trade of seed. At an international level the ISF uses the ISTA Rules for the marketing of seeds.
- ▶ More and more national accreditation (for example, UKAS: the UK Accreditation Services and COFRAC: the French Accreditation Committee) refer to ISTA methods in their programs of accreditation of seed laboratories to ISO 17025.

2.2. Test Methods can be a Precursor to Regulations


For decades, strong ties were forged between the methods and regulatory developments and the seed industry. It is interesting to note that often the methods existed before the introduction of regulations. This was the case in Europe where, since 1930, the availability of methods has preceded the development of national regulations. The possibilities offered to monitor the quality of seeds with proven methods contributed to political plans to extend the development of agriculture after the Second World War (Marshall Plan). In 1966 the first guidelines for certification of seeds based on checks of analytical purity and germination appeared almost a century after the initial development of these tests by the founding fathers of seed testing. In the 1990s, major work on the harmonization of approaches between ISTA and AOSA enabled the EU and the US to establish equivalence arrangements that greatly facilitate the exchange of certified seeds from North America and Europe. Today most regulations that facilitate trade are based on internationally recognized methods.

2.3. Test Methods and Standards for Quality are often closely related

Following the parallel developments of methods and rules, links were gradually woven with legislative standards. For example, in Europe, according to the Oil and Fibre Plant Seed Directive (Directive 2002/57/EC, 2002; Directive amendments - 2002/68/EC, 2002) the maximum rate of contamination of sunflower seed by *Botrytis* is 5 per cent. However, the meaning of this quality standard is related to the size of the sample as shown in Table 3. The risk of certifying contaminated lots with more than 5 per cent *Botrytis* increases as the size of the sample decreases.

Table 3 Influence of Sample Size on the Risk of making a Wrong Decision for Certification of Sunflower Seed Lots contaminated by *Botrytis cinerea* (EU certification standard: maximum 5 per cent of contaminated seeds in a sample of 400 seeds) (Lower and upper limits are the limits of the confidence interval)

Threshold 5% contaminated seeds		limits of the confidence interval	
		400 seeds tested	lower limit 3.08%
	200 seeds tested	lower limit 2.42%	upper limit 9.0%



In the same way, the level of purity is directly influenced by the definition of pure seed. Jensen (2009) reminds us in his article on the history of purity entitled: *ISTA Purity Analysis and Determination of Other Seeds by Number from 1924 to 2006*, that the test of purity has evolved from the “strong method” to the “quick method” more suited to the needs of the seed sector.

We cannot therefore divorce the test methods used to check the quality of seed lots from the legislative standards used to control seed quality.

2.4. Methods are evolving to meet the Needs of Production and Commerce

The development of test methods follows very closely the needs of the seed sector in general. For the record I cite five examples:

- ▶ Historically a starting point for harmonization was the demand from the trade for internationally accepted test reports resulting in the ISTA Orange Certificates, and the ISTA Rules.
- ▶ The OECD demand for test methods applicable to seed mixtures (mixtures of species) that are becoming increasingly commercialized.
- ▶ Applications from the ISF to increase the size of seed lots to suit the conditions of production and transport. The size of seed lots of sorghum and vegetable pulses increased to 30 000 kg. after studies in 2008 (ISTA Rules, 2008).
- ▶ The growing need for methods to detect pathogens on seeds in the context where it is crucial to produce healthy seed to reduce pesticide use and produce more food. In the years 1960-1970, research into the development of analytical methods in microbiology, immunology and serology greatly benefited the quest for new seed-health tests. The same is now true for developments in molecular biology. These developments have led to the production of analytical methods for detecting seed-borne infection by fungi, bacteria, viruses, nematodes. Today, even if all markets

do not require regulation, control of sanitary quality of seeds for both national and international markets has become, in many cases, a major issue. To address the growing need for methods, it is crucial to consolidate the forces available. As a first example, the ISF, in creating the ISHI (International Seed Health Initiative), is a good illustration of this. The close partnership established between the initiator ISHI, who established the needs of industry and the ISTA Seed Health Committee, initiator of ISTA methods and responsible for the validation of methods, helps to advance the methods of detection of pathogens on seeds and gradually meets the needs of the seed trade. Another example is the case of the Consortium "Clavibacter", where the combined efforts of the EPPO, the plant protection organizations, the official seed-testing laboratories of European countries and the seed companies, allow quick progress in the setting-up of new methods by pooling resources.

- ▶ Finally, with the urgent need for methods to detect GMOs, ISTA has established a network of partner agencies, businesses and international organizations. This has led to the development of a system based on performance-based methods to overcome the lack of standard methods. However, today, many other organizations responsible for standardization of methods, such as the ISO (International Standard Organization) and ENGL (European Network of GMO Laboratories), are working on the standardization of methods for detection of GMOs in foods, plants, and by default in seeds. There is a risk that the methods developed may only be partially adapted to seed and this could create difficulties in commercial transactions. The combined experience of those involved is an issue that needs to be considered carefully, taking into account the specificities of seed.

2.5. Seed Testing Methods: A Tool to contribute to the Seed Production Programs in Specific Regions of the World

2.5.1. Methods for Tropical and Sub-tropical Species

ISTA is highly sensitive to the need for methods for poorly endowed parts of the world. Decades of work in Europe, America, Australasia, North Africa and the Mediterranean region have given results that we must now turn to the tropics and sub-tropics.

Within the priorities set out in ISTA, all technical committees develop programs on tropical species. For example, in 2009, the germination validated a method for *Brachiaria brizantha* (Aranciaga, 2009). However, the magnitude of the task requires resources well beyond those currently available to the ISTA committees. We need more laboratories to participate in trials and more seeds for the tests. A close partnership between ISTA and those involved in seed quality work in tropical and sub-tropical regions would accelerate the development of methods for these regions.

Fig. 7 Proposal of a Germination Method for a New Species: *Brachiaria brizantha*

ISTA validation study on germination testing of *Brachiaria brizantha* (A.Rich.) Stapf [Rules Proposal 2010 B.1.]

Ignacio Aranciaga, National Seed Institute, República Argentina

Summary

A validation study on germination testing of *Brachiaria brizantha* was carried out. Six laboratories were involved and each tested 400 seeds of three seed lots. The analyses of the results demonstrate that the following method is of sufficient repeatability and reproducibility to be included in the ISTA Rules:

Table 5A Part I Agricultural and vegetable seeds

Species	Prescriptions for:				Additional directions including recommendations for breaking dormancy
	Substrate	Temperature (°C)	First count (d)	Final count (d)	
1	2	3	4	5	6
<i>Brachiaria brizantha</i>	TP	20-35	7	21	KNO ₃ ; predry and KNO ₃

(extract : 06-2009 ISTA Method Validation Report 2009)

2.5.2. Assistance to Seed Production Programs in Specific Regions of the World and their Contribution to Increased National Autonomy for Control and Trade of Seeds

There are many programs for the development of seed production in developing countries. Sources of aid management and financing are quite diversified; there are many FAO projects and partnerships in the framework of programs supported by the European Union. These programs usually include a methodology component designed to assist laboratories in training towards a mastery of analytical methods that are required for accreditation. This assistance is usually provided by experts from laboratories of the partner countries who are also members of ISTA. The close relationship that is established during training gives recipients the opportunity to establish contacts with networks of laboratories accredited by ISTA.

The availability of standard methods is recognized internationally as one of the pillars of the production of seeds for agricultural development. In industrialized countries; the availability of methods for checking the quality of seeds has always been a great support for the seed industry and for governments in seed production programmes. In developing countries, where seed production is insufficient, the availability of internationally recognised methods is a first step in the setting-up of national seed production schemes: it facilitates the elaboration of regulatory standards such as seed certification. This allows countries to structure their seed production on recognized methods of control and become more independent in the assessment of seed quality and, consequently, in the control of the import and export of seeds. This facilitates trade.

Conclusion: What Future for the Harmonization of Methods?

A long road has been travelled since the inception of ISTA in 1924 and the publishing of the first international Rules and the creation of the Orange International Certificate in 1931. Used mainly by official laboratories for nearly 60 years, ISTA was opened up to the private sector in 1995 when it was also allowed to join and issue certificates. The standard methods listed in the ISTA Rules are now embedded in laws; in regulations; in programs of accreditation and they are widely used by industry throughout the world.

Tomorrow will we still need standardized methods? If so, will we be able to ensure the development of methods? Several lines of development can be proposed:

- ▶ Taking into account the evolution of analytical techniques such as molecular biology, machine vision and near infra-red spectroscopy to provide more efficient and effective analysis of quality attributes such as GMOs, pathogens and vigor.
- ▶ Taking into account technological advances such as priming, treatment and disinfection of the seed.
- ▶ Increasing the availability of methods for developing countries.
- ▶ Developing methods for tropical and sub-tropical species.
- ▶ Becoming aware of the increasing need for flexibility in methods, whilst ensuring that the needs of rigor and standardization are not neglected.
- ▶ Analyzing the cost/reliability, speed, ease of implementation of the standard methods and ensuring that they are available to all countries whether industrialized or developing.

In the medium term, there is good reason to be optimistic about the future of basic tests such as purity and germination. These tests are strategic for trade and are firmly rooted in national and international regulations. The development of these tests is guaranteed by the strength of the network of partners who all have the same goal: quality seeds!

But we, the seed sector, have to face questions. These questions come from the political and regulatory environment in which tests based on new technologies such as molecular biology are being developed. In the main these are tests for the detection of GMOs and the detection of pathogens in seed. Many organizations that work on foodstuffs, such as the ISO and ENGL for the detection of GMOs, or whole plants, such as the IPPC for the detection of pathogens, include secondary tests on seeds in their goals. On the one hand the seeds can draw benefits from this but on the other hand it may be

risky to extrapolate standardized tests for food and whole plants to seeds. The general nature of tests on food and whole plants may make them unsuitable for seed.

To conclude: on the one hand I take the opportunity of this Conference to appeal for cooperation and the avoidance of competition which would be counter-productive and would inhibit gains in productivity that could be achieved if we worked in synergy. On the other hand, I hope that all players in the world of seed have common aims and policies: i.e. the development and standardization of tests including those for GMOs and health diagnostics.

ISTA can lead these projects in close partnership with existing organizations and with the support of governments and industry. It will adapt to a changing agriculture.

Acknowledgements

I would like to thank Ronald Don (UK), Dr. Michael Muschick and Patricia Raubo (ISTA Secretariat), for their valuable suggestions, the review and the translation of this paper. I would also like to thank Bénédicte Brangeon (France) for her contribution in gathering data.

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DISCUSSION

FRANÇOIS BURGAUD (GNIS, FRANCE): Yes, I have just a comment. The problem is related to the use of ISTA tests by governments. I will take the example of an Orange Certificate. At the beginning, the idea of an Orange Certificate was good; it was to facilitate private exchange. But now you have some countries, that even for seeds which are certified with an OECD or a European certificate, have a compulsory Orange Certificate. That is also a new trade barrier. For example, ISTA organized an accreditation of private laboratories. It is good. But it's good also as an intergovernmental organization to ask the countries who are members of ISTA to recognize the official analyses made by accredited laboratories of private companies. Because until now, you have some countries which don't accept Orange Certificates which were made by accredited laboratories from companies. And some countries request an official stamp of an official government. So I think there are also some problems with ISTA and the OECD on which they have to work.

JOHN KEDERA (CHAIR): Thank you for those comments; I don't think we need to react to that. We can then move to the last speaker.

HARMONIZATION OF THE SEED REGULATORY FRAMEWORK AT THE REGIONAL LEVEL – EUROPEAN UNION

Mrs. PAIVI MANNERKORPI

The European Union (EU) consists of 27 Member States representing a single internal market for around 500 million citizens. The European seed industry is the primary supplier to Europe's food and feed chain. The internal market for seed has been developed since the 1960s through EU Directives which apply in all the Member States, ensuring the freedom of movement of seed. In terms of monetary value, the EU commercial seed market (agricultural crops including seed potatoes, vegetables, turf grasses) has now reached around 7 billion euros. The EU seed market accounts for over 20 per cent of the total worldwide market for commercial seed. Moreover, the EU is one of the world's largest exporters of seed.

The EU legislation on seed sets the conditions for its marketing, aiming at providing guarantees of quality and health to users. The marketing requirements are composed of two pillars: registration and certification. Registration of varieties in the EU Common Catalogues is a precondition for marketing seed of agricultural and vegetable crops in the EU. For a variety to be registered, it needs to be Distinct, Uniform and Stable. Moreover, varieties of agricultural species need to meet criteria with regard to their Value for Cultivation and Use. Quality characteristics are also required for fruit plants, vine, and forest reproductive material as well as ornamentals. In the certification process, the requirements concerning varietal identity and purity, germination capacity and freedom from harmful organisms are checked. The responsibilities of the breeders, maintainers, producers and suppliers of seed are subject to stringent rules. The EU rules are aligned with the international standards of OECD Seed Schemes, UN-ECE, ISTA and EPPO.

As regards importation into the EU, the basic principle is that seed produced outside the EU is considered equivalent to seed produced in accordance with Community legislation, e.g. seed may be marketed within the EU if the seed affords the same assurances as seed officially certified within the Community. The seed should be officially certified and seed packages officially closed in accordance with the OECD Schemes for the Varietal Certification of Seed moving in International Trade. Seed sampling and testing should be carried out in accordance with the methods of the International Seed Testing Association (ISTA) or, where appropriate, with the rules of the Association of Official Seed Analysts (AOSA).

An EU plant variety protection system has existed since 1994. On the basis of a single application to the Community Plant Variety Office (CPVO), a breeder may be granted an EU-wide IPR for a plant variety that is new, distinct, uniform and stable. At present more than 16,000 varieties of plants are protected under this system. The EU rules are based on UPOV standards (1991 Act).

In addition, the EU Rules on the Community Plant Health Regime, GMOs and Organic Agriculture apply to seeds.

Further information can be found on the following web site: http://ec.europa.eu/food/plant/index_en.htm.

* Head of Sector, Unit for Biotechnology and Plant Health, Directorate-General Health and Consumers, European Commission

DISCUSSION

CHAWDHRY UPMA (MINISTRY OF AGRICULTURE, INDIA): I have two linked questions. You mentioned the agricultural common catalogue. On what basis are the varieties entered in the catalogue? And secondly, is certification mandatory in your system? Or, in other words, do you have certified and non-certified seed or only certified seed? And in case there is a system to allow non-certified seed, what regulations would be applicable to that seed?

PAIVI MANNERKORPI (EUROPEAN COMMISSION): The requirements for the common catalogue are that there needs to be DUS testing in the Member States and also VCU testing. There also needs to be a denomination, a name for the variety, for fulfilling the rules. And this is done at the Member State level. So we have the rules but the actual work is carried out by the Member States and as soon as there is a variety incorporated in the national list, it will be notified to the Commission and we will add it to the common catalogue. As soon as it is in the common catalogue it can be marketed in the whole of the EU. So this is how we assure the movement of free varieties in the EU. Regarding certification, certified seed can be marketed in the EU. Our rules concern the major crops that are of major importance in the EU. So we don't have all crops in the scope of our regulations. If a crop is not covered by our regulations, then national rules apply. So the marketed seed should be certified seed. But we are aware of the situation that the farmers are using their own seed; they are not necessarily using certified seed. And coming myself from a Nordic country, we know this situation well. But they are taking certain risks if they are not using certified seed.

TAZI (FAO): We know that there are some private companies from the EU producing seeds outside of Europe. So if a certified seed in a given country which is not in Europe is imported by one country in the EU, is it freely traded within the EU community?

PAIVI MANNERKORPI (EUROPEAN COMMISSION): We have the EU regulation on equivalence and maintenance so if something is maintained outside the EU, it should fulfill these requirements, and also the requirements on imports.

TAZI (FAO): Well sometimes the seeds are certified by a national government or a national authority within a country, for example, in Africa. Then the seed from this company from the EU, that is thus produced outside of Europe, is imported in order to enter a given country in Europe, for example the Netherlands or France. Is the movement within the other countries then free? Is the seed in this situation freely traded within the EU?

PAIVI MANNERKORPI (EUROPEAN COMMISSION): That is an interesting situation. And I wonder if some of the Member States are in a better position to answer this question, because this is obviously a question of controls. But to answer your question, once the seed enters the EU then it can be marketed freely throughout the EU. However, at the entry point (country where the seed enters), the seed should really fulfill the requirements that I have outlined.

JOHN KEDERA (CHAIR): I think that's a challenge to the EU countries responding.

HOSEA SITIENEI (KENYA SEED COMPANY LTD): Occasionally we import seed from other countries, with very good germination results shown on the Orange Certificates. But when that seed is tested locally, sometimes it doesn't meet requirements. How should the importer be compensated? Because we rarely get compensated at all.

PAIVI MANNERKORPI (EUROPEAN COMMISSION): If I understood you correctly, when seed is imported, for instance, from Tanzania, it should fulfill these requirements with regard to the seed testing and the labels. ISTA certificates and OECD labels are required. Did I answer your question?

HOSEA SITIENEI (KENYA SEED COMPANY LTD): No, my question is that sometimes you get seed with very good results as shown on the Orange Certificates, but when it is tested in your own country, the seed does not meet the requirements. As an importer you lose in terms of time and money and you don't get any compensation at all. How should the importer be compensated?

PAIVI MANNERKORPI (EUROPEAN COMMISSION): Thus we are talking here about the compensation in the moment where some requirements are not fulfilled. I think that for this kind of question it's a matter of the agreement between the seller and the buyer. Our EU rules do not deal with compensation in the case of non-fulfillment.

AAD VAN ELSEN (PLANTUM, THE NETHERLANDS): I would like to make an addition to your comment. You mainly talked about certified seed, but I would like to add that vegetable seeds are not traded as certified seeds but as standard seeds and therefore they do not need any VCU. Also in your graph, on the turnover of the size of the market, it was only talking about certified seed and certain agricultural species and not vegetable species because that would change the data considerably.

PAIVI MANNERKORPI (EUROPEAN COMMISSION): Yes, thank you for this clarification.

GARLICH VON ESSEN (ESA): Just a comment, because this is also designed for exchanging experience with existing systems. I think what has come out of the evaluation so far is that farmers and breeders still face the same big issue and that is competitiveness. They also rely on the same pillars of the existing seed system in the European Union; DUS to ensure identity of varieties; VCU or, for vegetables, non-compulsory but similar quality standards to ensure performance and seed certification, or for vegetables, similar systems to ensure quality. All of that has worked well, and that has been the unanimous result of the evaluation that has taken place so far. So if you are looking for a blueprint for a successful system, this is it. However, as you mentioned in your speech, there are areas where improvements are required. And there is one I would like to point out: the challenges that arise from new technology, for example with GMOs. As soon as the systems start mixing up seeds with other things like food and feed, we get into trouble. If we stick to the way we are dealing specifically with seed, and try to find seed-specific solutions, things are possible and they are not even that complicated. But as soon as the seed system is challenged by trying to apply rules or standards that are not designed for seed, that is the moment when the seed industry and farmers get into trouble. Adventitious presence of GMOS in conventional seed is a typical example of that. It has been singled out as one of the main areas where improvements are required.

GENERAL DISCUSSION

ISABELLE CLEMENT-NISSOU (GNIS, FRANCE): I have a question in relation to the IPPC. Yesterday we spoke of plant breeding on genetic resources and the plant treaty, but we also have to address the context of the Convention on Biological Diversity. Last April the European Union posed the question of access to genetic diversity to pathogens. I would like to know if the IPPC has addressed this question.

JOHN KEDERA (CHAIR): The IPPC representative had to go to another meeting, but what I know for a fact is that the IPPC deals with the pests on plants. So anything that becomes a pest on plants can accurately be dealt with in the context of the IPPC framework. That is the current position.

ISABELLE CLEMENT-NISSOU (GNIS, FRANCE): Thank you, it's our view, but did you address the question of access and benefit sharing? We always say that, when we have a more relevant forum, we have to go to the IPPC, to OEF for animal pests or to WHO for human pests, etc. But how will you address or are you prepared to address the question of access and benefit-sharing? Just in a few words, "yes", "no", or, "perhaps in few months".

JOHN KEDERA (CHAIR): Sorry I am attempting to answer the question on behalf of the IPPC; the consultations are I think between the IPPC and the other relevant body. I believe that at the next CPM we will have a clear statement. The next CPM is in April next year.

JOHN HAMPTON (ISTA): I would also like to come back to the IPPC. We know that the lack of sufficient seed health testing methods is one of the major problems we face in international seed trading. And while ISTA and ISHI have been working together for several years now on developing seed health testing methods, we have been desperately trying to get some sort of connection with IPPC, by "we" I am talking about ISTA. And to be frank, what has happened so far has been very frustrating. I would like to come back to our Secretary General's question on how, by the end of tomorrow, we can come up with a method where we do have the ability to work together and try to solve one of these most important problems for seed trading.

JOHN KEDERA (CHAIR): I think I attempted to answer that question when talking about the ISTA initiative for a collaborative arrangement with CPM. There was even supposed to be a joint workshop, a seminar in Geneva, but unfortunately the staff resources at the IPPC at that particular time were not strong enough to go through with the seminar, so it did not happen. But there is a commitment to work together to sort out the issues, and I think there was another question that was raised on whether we can have a consolidated ISPM that deals with seeds. These are the issues that can actually be discussed. So it is an issue and since I am currently on the advisory bureau of the CPM, I will raise it with the bureau at its next meeting. But it is an issue that needs to be discussed, particularly as we operate in our own individual countries.

MICHAEL MUSCHIK (ISTA): You mentioned that our joint seminar has been postponed on a request from IPPC. Has another date been suggested when we can have this seminar, has it been discussed in the bureau of the IPPC already? If not than please bring it forward.

JOHN KEDERA (CHAIR): Very well, point noted.

JUSTIN RAKOTOARISAONA (AFRICAN SEED TRADE ASSOCIATION): I have a general question for this session, especially on the seed trade. One issue that the industry is facing is the issue of re-exports. Seed is produced in one country and then it is brought to a second country, and from there it is exported to a third country. Now under the IPPC, can we take up this issue? Suppose that a seed producing country, for example Chile, is given the phytosanitary certificates with all the additional declarations, and then the seed goes to Japan and from there, the seed has to be exported to South Asia. Now the NPPO and Japan will not issue the same additional declarations that they have been getting from Chile. This is one of the serious issues that is affecting the seed trade, so I was wondering if we could address this issue. And the second issue regarding the IPPC members or the NPPOs is: Can they trust each

other's declarations?. A certificate is issued from Holland, and when it goes to, let's say, the Philippines and the Filipino NPPO says they don't trust this certificate, we have to do all these things again. Then it takes one or two months. So this is the practical issue we are facing in the seed industry.

JOHN KEDERA (CHAIR): There are guidelines on the issuance of our export certificate. And that is what should guide national plant protection organizations in the issuance of the phytosanitary certificate. Now, if it is not in compliance, or if it is not issued in conformity with that guideline, then it is an issue that needs to be looked at. But I can sympathize with the issues that you have raised, because all of the NPPOs tend to be separate entities and they have guidelines. And I think that's what one person has raised here; whether or not the NPPOs need to work together with the rest of the seed systems so that you have almost a one-stop shop. Remember that each of the countries has a national system in place. And you cannot just go in and change it overnight; it takes a while. In some countries they work together and in other countries there are totally different ministries dealing with the issue. Even getting them to talk to each other is a challenge. So at the policy level it is an issue that needs to be raised, because if we don't raise it, then it causes problems to trade.

ADELAIDA HARRIES (IOWA STATE UNIVERSITY): I have several questions, one to Mr. Ryan. I would like to know what is the annual fee or the contribution for countries to join the OECD Schemes because that is a problem for developing countries to become members. The other question is for you, Mr. Chairman, about the activities that the NPPO can delegate to the private sector under the IPPC Convention or the SPM measures. Is there any activity that can be conducted by the private sector? And the other comment is, at the end of the first presentation, you mentioned that small companies in developing countries have a fear that big or multinational companies can come to these countries. Were you referring to a lack of the harmonization process? It wasn't clear for me.

MICHAEL RYAN (OECD): I will deal with the first question regarding the OECD fees. The fees are very reasonable. When a country applies to join the OECD Schemes, there is no fee for the application. It's only when a country becomes a member that a fee is paid. The fee that is estimated for a country is composed of two parts. There is a base fee – and the current base fee is 2,500 euros and that applies to all countries. In addition, there is a second part which is a scale formula. The scale formula is related to the size of the country, more specifically the economic size of the country. And there is a rating given to each country depending on its economic power in the world or its economic size in the global economy. For developing countries it is very low, whereas for the most developed and the larger economies it is much higher. So there is a base fee and a scaled factor, but overall fees are very reasonable.

JOHN KEDERA (CHAIR): Regarding the question on the delegation of phytosanitary activities. I don't know of any that are prescribed at the IPPC level, but the workings at the national level can come up with systems to address the competences that do exist. However, at the IPPC level we have not gotten into the delegation of responsibilities. But at the national level, there are many working models, as long as the NPPO finally takes the responsibility.

I would now like to close the discussion. You will have the chance to discuss more issues tomorrow at the policy forum. Therefore, I will move to attempting a summary of what we have discussed today, taking into account that we may not have exhaustively addressed all of your questions.

One is that we know the global market for seeds has increased tremendously. We know again that international certificates and labels are being used at an increasing rate, be they for variety certification or for phytosanitary measures. We also know that the international regulatory framework is accurately being applied in many countries. Also we have learned that regional frameworks have been developed, and most are based on what is happening at the international level. We have also seen that seed is a highly regulated commodity. That is because it is where production starts. In addition, we say that cooperation, partnership, understanding, appreciation among all the players, be they public, national, international, or private, is essential if we are to move to the next level. And implementation of measures, that may be different in all the countries around the globe, is key to the success of the seed industry.

Session 5. Conclusion, presented by the Chairperson Facilitation of trade and market development

- ▶ Global seed market has grown rapidly in recent years and is currently estimated at about US\$37bn. Europe, North America and Asia account for almost four-fifths of the global seed trade. For 2007, the international seed trade was estimated at US\$ 6.4bn.
- ▶ The use of international certificates for varietal certification, phytosanitary measures and laboratory testing has greatly facilitated the development of the international seed trade.
- ▶ Production and marketing of certified seed of all agricultural crops is highly regulated at both the national and international level. A transparent and efficient regulatory system is crucial to ensure that farmers have access to high quality seed at a reasonable price.
- ▶ The international regulatory framework consists of certification based on varietal identity and varietal purity (OECD, AOSCA), phytosanitary measures (IPPC, WTO-SPS, NPPO), plant variety protection (UPOV) and seed testing (ISTA, AOSA, etc.).
- ▶ Regional seed regulatory frameworks have been developed and harmonised to facilitate regional trade e.g. Central America, Mercosur, EAC, SADC, ECOWAS, etc. Regional standards, such as those of the EU, are closely aligned with international standards such as those of the OECD and clearly set out the registration and certification conditions for the marketing of seed.
- ▶ The increasing use of harmonised international certification procedures on varietal identity and varietal purity helps to facilitate the import and export of high quality seed by assuring consumer confidence and reducing technical barriers to trade.
- ▶ Good cooperation between the public and private stakeholders in developing and setting standards that are internationally acceptable has facilitated the issuing of certificates which, in turn, has contributed to the growth in trade.
- ▶ Implementation of measures to prevent the introduction and spread of plant pests is critical to ensuring the development of a viable and sustainable global seed market. The International Standards for Phytosanitary Measures (ISPMs) provide useful guidance on the application of phytosanitary measures to the international seed trade.

Policy Forum

► **WELCOME**

Mr. BERNARD LE BUANEC, Chairman of the Organising Committee

► **WELCOME**

Mr. SHIVAJI PANDEY, Director of Plant Production and Protection Division (AGP), FAO

► **WELCOME ADDRESS**

Mr. FRANCESCO BONGIOVANNI, Dirigente ufficio sementi, Ministero delle politiche agricole alimentari e forestali, Dipartimento delle politiche di sviluppo economico e rurale, Italy

► **KEY NOTE SPEECH**

Mr. M. S. SWAMINATHAN, UNESCO Chair in Ecotechnology, Member of Parliament of India and Father of the Indian Green Revolution

► **CONCLUSIONS OF THE EXPERT FORUM**

► **OVERVIEW OF THE EXPERT FORUM**

Mr. BERNARD LE BUANEC, Chairman of the Organising Committee

► **PROVIDING AN ENABLING ENVIRONMENT (PANEL DISCUSSION)**

► **CONCLUSIONS OF THE 2ND WORLD SEED CONFERENCE**

WELCOME

Mr. BERNARD LE BUANEC*

Good morning Ladies and Gentlemen,

Welcome to the third day of the Second World Seed Conference. As you know, the first two days of the Conference were an expert forum, where we discussed technical issues in some detail. This third day is more a day for policy discussions based on the conclusions of the expert forum.

Today we will start with welcome speeches from a representative of the Director General of FAO and the Italian Ministry of Agriculture. Then we will have a key note address by Professor Swaminathan and after that we will have the presentation of the conclusions of each session of the expert forum. After that we will have a panel discussion on all those topics.

I wish you an interesting morning and I'm going to give the floor immediately to Mr. Pandey who is going to welcome us on behalf of the Director General of FAO.

* Chairman of the Organizing Committee

WELCOME

Mr. SHIVAJI PANDEY*

Mr Chairman,
Honorable Ministers,
Dr M. S. Swaminathan, UNESCO Chair in Ecotechnology and Father of the Indian Green Revolution,
Distinguished Delegates,
Ladies and Gentlemen,

It is a great pleasure for me to welcome you to this important policy forum on "Responding to the Challenges of a Changing World: The Role of New Plant Varieties and High-Quality Seed in Agriculture". This policy dialogue on seed is opportune as it is taking place in the wake of the forceful declaration of the G8 summit for stronger support for agriculture and just two months before the World Summit of Heads of State and Government on Food Security, November 16-18, 2009 in Rome. In addition, we are mindful of the fact that the climate change debate and its implications on food security will take place in Copenhagen in December 2009.

Distinguished guests, I would like to share with you FAO's views on how to address the situation of food insecurity in a changing world.

We are in precarious times characterized by a worsening global food situation with the following consequences:

- ▶ The number of people suffering from chronic hunger in the world topping one billion.
- ▶ 100 million more people are being pushed into chronic hunger and poverty.
- ▶ Reducing per capita agricultural land as a result of population increase and vastly expanding urbanization.
- ▶ Declining crop productivity growth rates worldwide.
- ▶ A food price crisis that has raised the alarm among many governments, the UN and other national and international organizations.

Traditionally, the seed sector has played a primary role in increasing food production. For example, during the last 60 years, wheat yields have risen from 2.5 tons to 6 tons/hectare. However, such gains in global agricultural productivity have not influenced the crop yield in many developing countries, particularly Africa, where yields are still very low. On average, nearly 90 per cent of cereal farmers in developed countries use improved seeds, while only 5 to 10 per cent of farmers in the developing countries of Africa and Latin America buy and use improved seed. To illustrate the disparity in investment in the seed industries of developed and developing countries, we need only to note that of the nearly 36.5 billion US dollar global seed market, Africa accounts for only 1.1 billion US dollars and Central and South America accounts for 3.5 billion US dollars.

The underlying cause of this tragic situation is the neglect of agricultural investment in developing countries. Official Development Assistance (ODA) going to agriculture has fallen drastically and international aid to farming in poor countries slumped from 17 per cent of total ODA in 1980 to 4 per cent in 2006. Developing countries also did not increase their own investment in agriculture; instead they reduced it.

In the 1970s, the ODA devoted to agriculture helped develop irrigation systems, storage facilities, rural roads, seed multiplication centers and fertilizer and animal feed plants. With countries also allocating a significant share of their national budgets to farming, those investments saved the world from looming famine in Asia and Latin America. Donors and recipient countries must return to those levels of investment in agriculture, as a minimum.

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Feeding the hungry today and roughly doubling food production for a world population projected to grow to over nine billion by 2050 will require political will for strengthening institutions involved in agriculture, including the seed sector.

In an effort to reverse these present trends, the Member countries of FAO have adopted sustainable intensification of crop production as one of its strategic objectives. This approach requires the integration and harmonization of all appropriate crop production policies and practices for increasing crop productivity in a sustainable manner to meet key millennium development goals of reducing hunger and preserving the environment.

FAO has called for the November Summit to help reverse the downward trend of investment in agriculture. The objectives of the Summit are to:

- ▶ Reach a consensus on eradicating hunger from the face of the earth by 2025.
- ▶ Put in place a more coherent and efficient system of governance of global food security, with a high-level intergovernmental process of decision-making, a solid scientific and technical basis more inclusive of different actors.
- ▶ Provide farmers in both developed and developing countries with an income comparable to that earned by their fellow citizens in the secondary and tertiary sectors through support to agriculture that does not distort markets.
- ▶ Boost development aid and reverse agriculture's share of ODA to 17 per cent.
- ▶ Adopt a mechanism for early reaction to food crises on the model of the early warning systems which proved very effective in 2007.

Despite some recovery of stock levels of cereals in 2007 and 2008 from the extremely low levels they had fallen to, 31 countries - of which 20 are in Africa - are in a situation of crisis requiring emergency assistance. As an emergency measure, FAO, through its Initiative on Soaring Food Prices (ISFP) has mobilized 380 million US dollars through 194 projects to provide improved seed and fertilizer to vulnerable agricultural households to increase their production in 102 countries. Of this, 286 million US dollars for 25 countries is from the EU Food Facility, and 37.1 million US dollars from FAO (TCP) for 74 countries. An additional 19.3 million US dollars is from the UN Central Emergency Response Fund. But there is a need for more medium- and long-term action to prevent a recurrence of this situation.

The present crisis may be a warning about the fragile status of global agriculture and for the need to accelerate investment in agriculture at all levels to prevent future food-price shocks. In particular, there is a need to strengthen national seed systems to make them more resilient. Also, there is a need for a strategic approach along with the participation of public and private sectors, community-based organizations, an enabling environment, resources, and a long-term perspective so that the seed industry can continue to play a key role in increasing food production.

How will governments respond to these challenges?

Primarily, there should be adequate investment in agriculture from both domestic and external sources. Such investment should consider, among other things, the development of a seed system capable of delivering the benefits of plant breeding to farmers, regardless of their scale of operation. To stimulate this line of action, FAO's role includes assisting Member countries to analyze their agricultural sector and develop bankable projects to bridge gaps. A case in point is FAO's assistance to the African Union to formulate the African Seed and Biotechnology Programme (ASBP), a continent-wide seed development initiative, in which partners will collaborate to advance seed development in Africa. In addition, FAO has facilitated the development of regional seed associations like the Asia and Pacific Seed Association (APSA) and the ECO Seed Association (ECOSA) in Central Asia and the Caucasus.

Secondly, governments should develop appropriate policies and investment – a friendly legal and regulatory framework to facilitate private sector investment in the seed and agro-industries. The synergy between the public and private sector must be harnessed to achieve this goal.

And, last but not least, the increasing pressure from climate change is likely to aggravate the difficult situation already faced by resource-poor farming communities. FAO proposes to lead a global initiative in cooperation with our international partners to elucidate the contribution of efficient seed systems in climate change adaptation.

Ladies and gentlemen, FAO is committed to the fight against hunger and poverty and will do what it can to help achieve the universal goal of hunger eradication in a sustainable way. FAO recognizes the important role the seed sector must play in this fight.

Thank you for your kind attention.

WELCOME ADDRESS

Mr. FRANCESCO BONGIOVANNI*

The Italian Seed Trade and the Importance of Breeding New Varieties

It is difficult to measure the entirety of the seed trade in Italy, because of the high number of steps in the chain of production, the resulting business income and the total surplus value (added value). Annual trade analyses performed by INEA, on the basis of ISTAT statistical data, give us a monetary estimate of seeds when they are employed for intermediary use.

According to the most recent financial statistics of 2006, the Italian seed trade appears to be stable if it is compared to the evolution of other agricultural sectors at current prices. In fact, during the decade from 1995 to 2006, the seed price more than doubled, rising from 997 million euros to more than one billion euros. However, the quota of this sector on intermediary uses decreased from 6.3 per cent in 1995-96 to 5.9 per cent in 2005-2006. This denotes that seed utilization is generally steady in respect to intermediary uses.

About 300 seed companies of variable dimensions work on national territory and produce agricultural species, while about 100 companies produce vegetable species. The number of farmers working in seed propagation is 15,000. The area aimed at seed propagation is 230,000 hectares, with a seed production of 612,000 tons (2008) which put Italy among the EU's top producers. The highest level of seed production was detected in durum wheat (91,000 hectares) and rice (12,000 hectares), followed by other cereals (40,000 hectares), forage species (30,000 hectares), maize (6,000 hectares), vegetables (10,000 hectares) and beet (4,000 hectares).

In the context of quality, it is worth noting that the procedure for acceptance is different in the cases of agricultural species and vegetable species. In addition to the requirements of distinctness, uniformity and stability, agricultural species must be of satisfactory value for cultivation and use.

In the past, the concept of value for cultivation and use of a certain variety included only its productivity. Recently, the qualitative characteristics linked to the destination of use were added to this concept. In other words, even if productivity is one of the most important characteristics in evaluating a new variety, it must be related to that of a known variety with a similar destination of use and not to the average productivity of the species.

In addition, with regard to quality and threshold in GMO products, in the Agriculture Ministry we think it is necessary to consider that in the context of all production processes seed is not a final product but a raw material. For these reasons, in the case of seed it is difficult to provide for a labeling threshold of the adventitious and technically unavoidable presence of GMO. The use of GMO seed necessarily causes its adventitious presence in subsequent products (raw material, food and feed, intermediate seed products). Consequently, the threshold of presence of GMO in seed should coincide with the limit of detection of the method used for GMO analyses.

Concluding, the weak spot in Italian seed chain production is the small number of new selected varieties, in other words, lack of innovation.

The fragmentation of the seed system has not allowed the original breeding activity to be transferred from the public sector, where it was born and developed, to the private sector.

It is desirable that an extension service be developed in Italy as in the US, working side-by-side with researchers and able to suggest and stimulate the realization of useful innovation, to individuate

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adapted areas of cultivation, to make every step in production (from breeding of varieties to packing and marketing) efficient.

It is necessary to find a high synergy between public and private research in Italy. The former could be concerned with basic issues, the latter with the practical application.

In this context, public research could be financed by the royalty proceeds on certified seed or by a taxation system similar to the French one where 0.50 euro per ton of marketed product is collected.

Conclusion

Therefore, the main priorities of the seed trade are as follows:

- ▶ private and public sectors have to improve collaboration in research and in production;
- ▶ it is necessary to individuate new objectives for research, according to market trends and needs;
- ▶ national authorities have constantly to play a role in controlling the seed trade;
- ▶ quality, conservation of genetic resources and breeding of new varieties must take on a strategic significance.

KEYNOTE SPEECH

Prof. M.S. SWAMINATHAN*

Plant Breeding for an Evergreen Revolution and for Meeting the Challenge of Feeding a Growing Population in an Era of Climate Change

Mr. Bernard Le Buanec,
Members of the Podium,
Distinguished Participants,

I feel very privileged to have been asked to share some thoughts and some forecasts relating to plant breeding for an evergreen revolution in an era of climate change. I will show you a few examples of what needs to be done and also share my own views on what the priorities have to be in the coming 10 years or so if we are to meet the new challenges to which Mr. Shivaji Pandey, FAO and Mr. Francesco Bongiovanni of the Ministry of Agricultural Policy, Food and Forestry of Italy have both drawn attention.

First of all, I want to pay a tribute to all of you here; those who represent the seed industry and seed research. People do not realize the enormous change which breeding has brought about in crops in the last 10,000 years. Women, particularly, have contributed, because women in rural areas, the centers of life, have been in charge of post-harvest technology. For example, in the case of hybrid corn and maize, we have come from teosinte to maize and, in the case of wheat, from agropyron and aegilops to modern bread wheat. This can be compared to the transformation of a tiny neolithic pony into the modern racehorse. So I would like to congratulate you on the changes which you have brought about.

Incidentally, the expression “green revolution” was coined by Mr. William Gaud from the US in 1968 and I would say it is used in the context of higher production and productivity improvement. The DG of the FAO has said: “Land is a shrinking resource for agriculture, therefore what we need is more productivity per unit of land and per unit of water” – that’s what we need in the future. The green revolution in modern genetics started with hybrid corn in Iowa in the US. The Pioneer Company played a very important role with Henry Wallace and others. They encouraged the use of hybrid maize to make the first quantum leap in terms of productivity using hybrid vigor.

Then, of course, the modern term “green revolution” is related to the revolution in wheat and rice. There is a very important pedigree in the case of wheat, which has changed the world: Japanese scientists, led by Dr. Gonziro Inazuka in 1935, identified the Norin 10 gene, which meant short plants, but very long panicles. In other words, the pleiotropic effect between height and panicle productivity was completely de-linked. We also have many varieties of wheat which are short, but they also have very short panicles. Here the link was broken. There were two major streams of research using Norin 10 after World War II. One was in Washington State, where Dr. Orville Vogel and his colleagues developed outstanding dwarf winter wheat, one of the first of which was Gaines. It still, I think, holds a world record in wheat yield – 14 to 15 tons per hectare. The other was by Norman Borlaug*, (we should all pray for him because he is not very well now): he and his colleagues in Mexico started on spring wheats. Borlaug did something else; he not only tried to put in the short variety stature, the Norin 10 genes, but he also got rid of thermo-sensitivity in terms of flowering, phyto- and thermo-sensitivity, by starting what is called shuttle breeding. Shuttle breeding under two very diverse conditions – one long day followed by one short day - with the result that he was able to get rid of genes for photo- and thermo-sensitivity. This is why Norman Borlaug’s initial Mexican strains, Lerma Roja 64 A, Sonora 64, Mayo 64 etc., became more popular in the developing world because we cannot grow winter wheat; we can only grow spring wheat. So these two strains, one on winter wheat, the other on spring wheat, practically changed the whole history of wheat in the world.

* UNESCO Chair in Ecotechnology, Member of Parliament of India and Father of the Indian Green Revolution.

Now people talk about the green revolution in Africa; I have heard Mr. Kofi Anan talking about Africa's green revolution. But unless you identify why a green revolution occurred, we can go on talking and nothing will happen. At least in the Indian context, four very important ingredients were essential. First is technology: technology is the prime mover of change. We had varieties which could yield five, six, seven tons which attracted the attention of farmers because from one ton to six tons is a very substantial step, not only in terms of technology in breeding, but also in agronomic practices. Then the services, which are needed to take the technology to small and medium farmers: in most developing countries in Africa and Asia, over 80 per cent of farmers have barely one hectare or less.. Therefore, the services which are needed, particularly seed production and distribution become important. Insurance, credit, fertilizers and irrigation are also important. Then the public policies: this is what is lacking in many countries where people want to have a green revolution but nothing happens. Because you can demonstrate this in the farmer's field – hybrid corn gives you a much higher yield, but it doesn't spread; if the farmers grow more, they will suffer because the prices will crash.

Assured and remunerative markets are the prime mover of farmers' enthusiasm; without their enthusiasm, nothing will happen. They are the people who are producing food, you and I are helpers, we are friends and philosophers, but the actual work is done by the farmers – in sun and rain they work: agriculture is the most risky profession in the world. In my country now we have drought in many areas, farmers have lost their seed, the first sowing. Now in Kenya, there is a very serious drought in many places. So many people do not realize that farming is the most risky profession in the world. This is why public policies which can ensure a stable and remunerative market are imperative. You can go on talking about green revolution for Africa, nothing will happen unless you put all the ingredients together – above all motivate the farmers. They should become enthusiastic. In other words, your attitude should be from patronage to partnership. Most of the programs are designed on a patronage principle and unless you change your mindset from patronage to partnership – without the people there, nothing will happen.

In 1968, Mr. William Guad coined the term "green revolution". Within a few years the non-governmental movement, particularly environmentalists, loudly criticized the green revolution. They felt it served company-oriented technology in the sense of requiring more fertilizer, more pesticides, etc. This was the origin of concerns about new technologies from the environmental point of view. It started with Rachel Carson's famous book *Silent Spring* in 1962, where she said the eutrophication of lakes, the excessive use of DDT, the long-lasting residual toxicity of pesticides ought to be controlled. That is why from that time onwards there was concern. To allay this problem, I coined the term about 30 years ago "evergreen revolution". I defined the evergreen revolution as "the enhancement of productivity in perpetuity without associated ecological harm". In other words, you have to mainstream ecology in technological development and dissemination.

I was happy when the Crop Science Society of America, for their 50th Anniversary, chose the theme "From the Green to the Ever-Green Revolution". Those of you who are interested in ensuring that whatever we introduce as technologies are environmentally sustainable – sustainable in the long-term, not only for short-term gains should read the proceedings of that meeting. They asked me to give a lecture on "The transition from the Green to the Ever-Green Revolution". It has a number of steps, but briefly, the green revolution as coined in the Asian context was a commodity-centered approach: rice, wheat, corn, pearl millet, etc.; many crops were concerned. It involved a change in plant architecture, in harvest index, that is the translocation of photosynthates to the grain. Then the change in the physiological rhythm – I have explained to you what Norman Borlaug did by means of shuttle breeding.

The evergreen revolution, increasing productivity and perpetuity without associated ecological harm, can have two major routes: one is organic farming. Organic agriculture is now gaining more and more because, in the Western world, health foods have become very important to people. Therefore, they are willing to pay a higher price for organic products; organic stores are opening up. The other route is green agriculture. Green agriculture is also environmentally sound, but on the other hand, it depends on integrated pest management, integrated nutrient supply. In conservation farming, which is now given very high priority in the US under the US Farm Bill. Now, if farm ecology and economics go wrong, nothing else will go right: in farming, ecology and economics are basic. Some people think that organic farming means going back to the past and then we will have only starvation. What

people have to realize is that organic agriculture needs more research support than even chemical farming.

I have shown you what biotechnology has to do for sustainable organic agriculture. In the case of the International Federation of Organic Agriculture Movement (FOAM) they have said that no genetically modified crop can be included for certification in organic agriculture. But marker-assisted selection they have accepted; marker-assisted selection is possible for organic farming, but genetically modified varieties and recombinant DNA technology cannot be used. Since we all require plant health, in the case of organic farming, unless you have broad genetic resistance, you will have to use a lot of pesticides. The answer is bio-pesticides; New improved ways of keeping, processing and transport of animal products are needed, because in many developing countries, crop and livestock are part of an integrated farming system. In my own country, mixed farming is a way of life as well as a means of livelihood. Mixed farming involving crops and animals, mostly ruminants such as buffalo or cows, also sheep and goats; poultry, is now also becoming important.

So in the case of soil health, there are two important requirements for organic farming: firstly, soil health enhancement – we are taking out, we need to put back – secondly, plant protection: soil health can be enhanced by bio-fertilizers, stem nodulating, green manure. If you are interested in breeding and seed production for organic farmers, or even if not, we have to intensify our work on nitrogen-fixing plants. Fertilizer trees and fertilizer shrubs must become an important part of breeding and seed production. For example, in the case of soil fertility enhancement, *Sebania rostrata* from Senegal is a very good plant. Now it is also stem nodulating. We have developed phyto-insensitive varieties of the *Sebania rostrata*; you can fix it in crop rotation; you can keep it going in 40 to 50 days. Breeding of this kind of a whole series of nitrogen-fixing leguminous and nitrogen-fixing trees is now common thanks to the work of the World Agroforestry Centre (ICRAF) in Nairobi. They have been trying in the Sahel and many other parts of Africa to identify these nitrogen-fixing trees. One of the best trees is *Faidherbia albida*. It adds 300 kilograms of complete fertilizer and 250 kilograms of lime to the soil. In a number of experiments it shows that where you are going to grow sorghum or any other crop without any fertilizer, *Faidherbia* and other kinds of fertilizer trees can make that a success. So my appeal to some of you here, particularly those working in developing countries, is to focus on those objectives. In my country 60 per cent of the arable area is rain-fed, but this year we had drought. The farmers affected know about fertilizers, but they can't risk crop failure. African farmers don't put in more than six to seven kilograms – it is not that they don't know the value of the fertilizer, but they can't take the risk as there is no proper insurance. In India, for example, we are starting a one billion tree program of nitrogen-fixing trees as part of our climate-change mitigation program. The carbon trading and the carbon sequestration give us a double advantage; you sequester carbon on the one hand and fix a lot of nitrogen and nutrients in the soil – we want a win-win situation both for the climate and the soil.

Now I am trying to underline the need for all of us to favor some new pathways of breeding.

Recently in Aquila, not far from Rome, it was concluded that we can live with an increase of about 2°C. That was the main conclusion, although there are scientists who feel that at the current rate of emission, we will have an increase of at least 4°C with disastrous consequences for most of the developing tropical and subtropical countries. Addressing the World Climate Conference in 1989 in Geneva, the World Meteorological Organization (WMO) asked me to speak on "Climate change and agriculture". At the previous Conference in 1979, I was asked to speak on "Climate and agriculture"; in 10 years they had changed the title to "Climate change and agriculture". There I presented data to show that with an increase in temperature of 2°C, rice yields would decrease by 0.75 tons per hectare. In the whole of North India, wheat is highly sensitive to night temperatures. If the night temperatures are warm, then it starts developing fairly quickly and yield goes down by nearly half a ton, etc. Therefore, there are quite a few of us here from tropical and sub-tropical countries who should analyze in terms of plant breeding and seed selection, the impact of an increase of 2°C. Let us take the 2°C higher temperature now – what kind of temperature tolerances are required? This is important if you are breeding higher mean temperature. Again, before modern industrial agriculture arrived, local people depended upon a whole variety of crops; they had a whole series of crops, both for health and food security; medicinal plants for health. Indonesia, for example, had a very large number of excellent plants and varieties, but gradually, from

FAO data we see that we now depend upon 20 crops or so for the whole world food security system: rice, wheat, corn, soybean. In an era of climate change, we must again broaden the food security basket and include what we call orphan crops. The US National Academy of Sciences has rendered a very valuable service by publishing books on the lost crops of the Incas, the lost crops of Africa. There are two or three volumes by Noel Vietmeyer on the amount of loss in Africa. Many of them are very valuable for coping with micro-nutrient deficiencies, particularly what we call “hidden hunger”. Hidden hunger can be worked on through appropriate horticultural remedies for a nutritional malady. Now breeders like you would analyze: this is a nutritional malady so what is the remedy, using appropriate varieties and horticulture? Since Mr. Le Buanec asked me to talk on food and nutrition security, I am talking about areas which are important.

Then there is much more as I have said. For health foods, there is a great deal of interest in all the ancient traditional wisdom in relation to medicinal plants – for example, the medicinal rice Navara, which is very popular in indigenous Ayurvedic health systems in India. It fetches a premium price and there are a whole series of medicinal and aromatic rices. You see the lost crops of Africa; you will find a lot of plants with medicinal properties which have also been lost.

How do we really work with local communities? Apart from advanced breeding and biotechnology, participatory breeding and anticipatory breeding can help to look at the emergent challenges, particularly climate change. Participatory breeding with farm families contributes to ensuring that you have some varietal diversity. In other words, if you function as a pre-breeding center and work with farmers on participatory breeding, then you can have a large number of varieties so that you don't put all your eggs in one basket. If some new disease comes along, if you have homogeneity, genetic homogeneity, might enhance genetic vulnerability to pests and diseases. For example, we have been working with tribal families in a place called Koraput. The leader of that group, a lady, went to Johannesburg to receive the Equator Initiative Award for the work she and her group had done in participatory breeding which has now led to the birth of a new variety called Kalinga Kalajeera. Bangladesh also grows Kalajeera, which is a very high-yielding variety developed by participatory breeding; the demand for it has grown and it obtains a premium price in the market. You can immediately uplift the economic status of these women and those people here if you do work of this kind.

Then there are crops which are vanishing; they are also becoming important in an era of climate change. This slide shows people who have difficulties in walking. There is a neurotoxin in lathyrus. Lathyrus is one of those legumes which used to be very popular in dry areas of much of the central part of India. It is eaten widely during periods of drought since it is the only crop that gives some yield. If the population's intake exceeds a certain threshold they develop health problems. Now scientists have tried to remove those neurotoxins. You can do this in different ways; by mutation breeding, by somoclonal variation which as you know comes from tissue culture and micro-propagation. In other words, I am asking you, depending on the countries where you work, to look at the crops which offer a particular potential to solve problems. In Europe, long ago for example, the original lupin, through successful breeding, was replaced with a sub-specie lupin which did not contain cyanide.

Another area of great concern to Asia, South Asia in particular, is the increase in flooding. I am not talking about Turkey which has had very serious flooding in the last few days, but floods may become more common. The Himalayan floods this year and last affected what we consider North India, because the snow is melting earlier, the glaciers are receding and therefore you have more frequent floods. You have to prepare. One crop which can be an important management crop, a climate management crop, is rice. The reason is that rice grows under a wide range of conditions in India and from Kanyakumari to Kashmir. There are over 150,000 strains, landraces of rice, of which 100,000 are in the gene bank of the International Rice Research Institute (IRRI) in the Philippines and are increasingly important. You have plants which can withstand low water supply. New technologies of water management imply a further reduced water requirement by 50 per cent in the case of rice: the opposite is elongation. More recently, in the publication *Nature*, there was a very detailed paper by Moto Ashikari and his colleagues in Japan. They have identified the genes which are responsible for the elongation of rice with flood water. They identified response factors, which they called “Snorkel 1”, “Snorkel 2”; they also know the number of genes that are involved. It is important that now we identify potentially flood-prone areas. We can also transfer “Snorkel” by genetic engineering to other crops. Once we know the gene that is responsible for this factor, we can easily transfer it.

The other important crop where new approaches are needed is the potato. In India, we grow more potatoes than in the whole of Latin America, its ancestral home and we grow more than 30 million tons. The reason this has been possible is because we can produce potato seeds by planting the tubers in the Indian plains. Formerly we had to go to high ground or to Nepal to get the seed, now we can produce it because scientists have identified the season when there are no aphids to transmit the viruses. But with a rise of 2o centigrade, that season will disappear. How then do I manage my potato crop? It will have to be done only through seed. TPS (True Potato Seed) breeding today has become very international – the International Potato Center and others have been working on it. Bangladesh has a number of strains of TPS. For those of you who are interested in potatoes, please develop good TPS varieties that can be grown.

Then what about all the people who are going to suffer from the rise in sea levels? If Mr. Le Buanec had invited the President of the Maldives he would give you a very good lecture on the rise in sea levels and how his country will disappear under the waves as a result. It is not just a hypothetical concern – the rise in sea levels is going to happen. Now what do you do? You can't wait for it to happen, you will be able to do nothing then, but now we can do anticipatory work. Nature has provided us with the toolbox. In my country, Mahatma Gandhi said: "Nature provides for everyone's need, but not for everyone's greed". Nature provides halophytes, xerophytes, all kinds of plants. Halophytic plants like mangroves – wonderful plants – we call the bio-shield. We saw this during the tsunami in 2004; where there was a good mangrove plantation it acted as a breaker. We can now develop a number of varieties of mangroves, another advantage being that these plants also provide genes for salt tolerance (sea-water tolerance). Now my young colleagues are all in the final stages of work started in 1990 in transferring genes from mangroves for sea-water tolerance to rice and other crops. We have excellent salt-tolerant varieties in the field and are going to start trials as soon as the regulatory mechanism gives permission. They are all very good, economically superior varieties now containing genes for sea-water tolerance.

Similarly in the case of drought – the other problem. Increasing drought; increasing floods; rising sea levels; different temperatures, these are problems we have to cope with. In this case, nature again has provided wonderful crops. For example, *Prosopis juliflora* is very hardy – it can be a weed, it can be an asset – it depends on how you deal with it. It has provided genes from which my young colleagues have identified a number of factors as being relevant for drought resistance.

So, ladies and gentlemen, I think there are a series of opportunities here. In India there is talk about genetically modified crops. The only one which we have so far officially released is Bt cotton. We have a number of breeders in India in the private sector who have taken the lead in developing varieties of genetically modified crops wherever necessary; you don't genetically modify where it is not necessary. If I can find other genes for sea-water tolerance, I might not use mangroves. But I find mangroves are already growing, thriving in those conditions and therefore I take the genes out and insert them. It is important to adopt only those tools that can take you to your desired goal, speedily and safely.

In India, cotton is a very important crop; for example, cotton provides the highest number of jobs. Our problem is jobs, livelihoods. You can have food in the market, but people don't have the money. Therefore, livelihood becomes important. I was looking at the 1950s onwards, the last 50 to 60 years which I have lived through. What kind of changes have we been able to bring about, through breeding and seed selection and conventional breeding, starting from early disease-resistance, then fiber quality, on which we concentrated in the 1960s? We wanted to have the same quality as Egyptian cotton. So we developed varieties such as Sujata, a very fine quality in terms of the long staple. Then came the Pyrethroid era; synthetic Pyrethroid. But as you see, from 2000 onwards, there was a very steep rise in productivity, and not only in production. Last season showed a slight drop because of the extensive drought. But it has shown a dramatic increase, like the green revolution in wheat and rice, where suddenly production rose. Most of the area now is under Bt cotton. Our public sector institutions have a responsibility also to develop varieties, not only hybrids. The private sector essentially develops hybrids, but the public sector, for example, our Cotton Institute at Nagpur, developed the Bikaneri Nerma which is a farmer's variety with a very high resistance to bollworm and the Bikaneri Nerma Bt strain is doing very well. It does well under rain-fed farming. It requires low input agriculture and is less risky. At the same time, the farmer can keep his own seeds because in our Plant Variety Protection and Farmers' Rights Act, farmers have a plant-back right, but that is, of course, valid only in non-hybrid varieties. A hybrid you cannot plant back, you have to purchase the seed every year.

Now, there has been a lot of emphasis on cooking quality, as people become more sophisticated in their requirements through increasing urbanization. There is the basmati rice of Pakistan and India which is a very important area for export purposes. The recently introduced Pusa 1121 has created enormous interest because of its very fine quality. Farmers now use it on 75 per cent of their land. Very high productivity comes with high quality. So quality has become important for the progression of the transfer of genes to IRRI varieties. IR64, IR20: it is always important for a gene to be transferred to the best agronomic base. These varieties have received the gene from transgenic high-iron rice containing the ferritin gene. This gene, from mangroves, again by genetically combining, gives a very high iron content. According to FAO, anemia affects over two billion people, mostly pregnant women and, therefore, iron rich rice or staples can make a big difference and now you have very good varieties. The Consultative Group on International Agricultural Research (CGIAR) has a bio-fortification challenge program in seven crops: bean, cassava, maize, pearl millet, rice, sweet potato and wheat. They also have a time target – this is partly supported by the Bill and Melinda Gates Foundation “Harvest Plus” program. In my own center, we work on the ferritin gene – transfer of iron to rice and other crops. Now this is a well-coordinated program, a challenge, with a number of countries and institutions involved and the best available technologies.

As mentioned earlier by the representative of the Italian Ministry of Agriculture, it is important to have regulatory policies. Every country has to have a national biotechnology regulatory policy. We have, in India, at the moment a lot of dissatisfaction among the non-governmental organizations, with the existing procedures, so the government has come forward with an Act of Parliament, which provides for an autonomous professional body which will be purely science-based and which will be a national biotechnology regulatory authority. The bottom line for national agricultural biotechnology policy is the economic well-being of the farm family – that is number one. What is the purpose of this? National food security, health security of the consumer, bio-security of agriculture – these are becoming exceedingly important. Increasingly, H1N1, H5N1, SARS and also mad-cow disease are becoming additional threats. Today I saw a new kind of influence that is becoming problematic; bio-security issues have become major problems. The protection of the environment and trade security are of great relevance. The European Community does not allow any kind of genetically modified rice. So if I put genetically modified basmati on the market, it would kill my exports because people wouldn't buy it.

What is important for all of you under your corporate social responsibility? I think you should give high priority to conservation of genetic material. I spoke earlier of the orphan crops, knowledge dying out. We have to start at the farm level, on-farm conservation of the landraces. The 150,000 strains of rice would not have existed but for the fact that farmers had conserved landraces. So, too, on-farm conservation and national gene banks. We must also acknowledge the role of the Government of Norway and the Crop Biodiversity Trust which is located here and headed by Cary Fowler from FAO as they have done a good job with the global seed vault at Svalbard in the Arctic for what I call “conservation continuum”. For those who are interested in this, you can read my editorial in *Science* (July 31 issue). You'll see that from the field, from the farmers' field, to the global seed vault, we must have effective conservation of genetic resources.

We have not got this for animals as unfortunately, animal breeds are vanishing. Crop seeds are somewhat more protected, so in the case of animals, breeds must also be saved for posterity. There are some very hardy breeds of animals in the Rajasthan Canal area which are now disappearing and it is important also to conserve them in a warming climate. We must also promote community conservation, the field gene bank, the seed bank. This year the first crop was lost in most parts of India. Rains came on time, then for a month there was no rain at all, so whatever had been sown was lost and, as a result, farmers didn't have seed to sow again. In other words, these community seed banks and grain banks are particularly important in all parts of Africa and Asia. There needs to be seed banks and grain banks, water harvesting and water banks so that you can give crops life-saving irrigation when you have access to water.

Finally, let me conclude by saying as a tribute to you; you all know the saying that we reap what we sow. Good seed is a starting point for a good crop. Now what are the major requirements? I consulted my colleague, Dr. Niebur, who spoke about progress in plant breeding. However seed and seed quality do not receive adequate attention. There is a large gap between plant breeding work and field application. Therefore, what is called translational research is required. For example, we have

given about 20 million US dollars to ICRISAT, Hyderabad, purely for translational research – converting biotechnology innovations into field products. Translational research, the delivery system, the extension system; these are often weak. Today, there is much progress in plant breeding; however, seeds and seed quality are not receiving adequate funds. We need to invest in improving seed quality. As I mentioned earlier; progress in spreading good quality seed is required. However, there is another problem: the rising price of grain legumes. In my country, for chick peas and pigeon peas, prices are rising. Those crops are sources of protein for most vegetarians. Today they are not able to afford to buy them, because the good seed is not available. So in those cases we must promote seed villages in local communities. Women, particularly, are forming what we call self-help groups. Women sell crops for seed production and they are exceedingly good. Even cotton is included. I forgot to mention that when Dr C T Patel from Gujarat developed a cotton hybrid for the first time in 1970, many people asked how he was going to produce seeds by hand emasculation and pollination. The work was organized with women, tribal women, and they produce excellent quality seed.

So I think it is important to have more and more community farmer-managed seed systems which can derive original material from what is called the private/public partnership. I call a farmer-company a private/private partnership, because farming is the largest private sector enterprise. In my country, the land is individually owned by 150 million families. We had an archaic rule of requisitioning land and that led to tremendous protests from farmers, with the result that today no democratically elected government in India will take land from farmers. In other words, there are 150 million decision-makers for farmers. These have to grow and we must use farmer-managed seed systems and involve them much more.

Then you talk about biotechnology and the refuge. In the early days of Bt cotton, the farmer asked: what is the refuge. Why does the company give me the old seed, the old variety? There was not enough genetic knowledge. We have now started, with the Department of Biotechnology of the Government of India, a national movement in schools called DNA clubs or genome clubs. It is a very large genetic literacy movement, because in the future you are going to depend more and more on new products coming from modern biotechnology, which has opened up new horizons in terms of transfer of genes and it has to be used responsibly. But then people have to be prepared for it, to know the pros and cons; the genetic literacy movement. This is why we are starting first with the DNA clubs in schools. In this way we are moving into a new technological era, as we were doing at the time of your previous Conference 10 years ago in Cambridge.

The great difference between Cambridge and now is that more biotechnology has come in and therefore caused more controversy. The greater the power of science, the greater will be the need for the ethical dimension, so we should not be surprised. There is controversy. If you have got enormous power in using science, ethics must guide your use. So the ethical responsibility of science matters and I am sure that when Bernard Le Buanec organizes the next Congress, maybe five and not 10 years from now, you will see an enormous increase of recombinant DNA work. I don't know whether I will be alive. But I expect an enormous explosion of knowledge in using fertilizer plants, fertilizer trees, another method of enriching the soil and sequestering carbon – a win/win situation. I would like to see enormous progress in terms of anticipatory and participatory research with farming families to meet the new challenges of climate change.

I wish you continued success in the important work you are doing to safeguard human food security, health and well being.

DISCUSSION

ROBERT GUEI (FAO): In some countries, seed legislation does not allow farmers to manage their own seed and commercialize the seed. I would like to know your views on that.

PATRICK NGWEDIAGI (MINISTRY OF AGRICULTURE, FOOD SECURITY AND COOPERATIVES, UNITED REPUBLIC OF TANZANIA): I just wanted to get your view on what we should do in Africa. You have just told us the four components of a green revolution that took place in other parts of the world. In Africa we are now struggling to include those components and I think we are not yet there. Now you are talking of an evergreen revolution. What is your advice for us in Africa?

MICHAEL MUSCHICK (ISTA): I am still looking at your slide and it reads “seed quality is not receiving adequate attention” and I would be very interested in your concrete ideas to change this.

MOHAMED TAZI (FAO): Instead of giving emergency aid in Africa and developing countries, do you think that giving the genes instead of giving funds will be an option in the future?

PROF. SWAMINATHAN: On the question of seed legislation, farmers’ seed production, I think that any legislation should look at the methods of providing good quality seed for the farmers. The bottom line is a reliable and good quality seed supply which will germinate on normal quality parameters. In my view, farmers have a very important role to play here. Companies by and large develop hybrids which have to be bought every year and the companies can ensure the quality. But then you have self-pollinated plants, local varieties which are grown. When you change from more exploitive agriculture to sustainable agriculture, you require varietal diversity, more and more local adaptation. This is why I said some kind of pre-breeding plus participative breeding with farmers is much more important, because then you don’t have the risk of pest epidemics, as long as there is some varietal diversity. Therefore, I would request countries not to prohibit farmers from participating in seed production. If the farmers are working closely with companies, it is very good. In India, a lot of them are working, trying to produce seeds for the companies – contract cultivation, contract farming. But I would not discourage farmers’ seed systems because I don’t see, knowing some of the countries in all parts of the developing world, that purely one size will fit all. Any legislation must be encouraging – encouraging for production of good quality and adequate quantity of seeds. It should not be discouraging for the farmers. That would not be in the nation’s interest. We must recognize that we all live in this world, by courtesy of the sunlight, the green plants and the farmers who grow the green plants and can make them into food. They are the real hosts – all of us are only guests on the earth. Therefore, if the role of farmers is not recognized, I think it will not be good for the country’s progress, particularly where more than 80 per cent of people are farmers. Even in relation to WTO negotiations, many times the words “consumers” and “farm producers” are used. In India, for example, there are only two categories, consumers and producer/consumers: 70 per cent of producer/consumers and 30 per cent of consumers, even in urban areas. Now you have to think that more than one billion are undernourished, many of them farmers. Many of them are small to medium farmers working in non-irrigated areas and they are the producer/consumers. If you don’t help them to consume more, the figures will remain stubborn. I see the FAO’s figures are going up not coming down in relation to main development goals. They are authentic figures, but we must ask ourselves why it is so. In spite of all the concerns, again and again, every time the G8 or others meet, there will be promises of say 120 billion US dollars, but why is it that we are still increasing the number of people going to bed hungry, not reducing them? Time to ask hard questions.

The second question from our friend from Tanzania is very important. The whole question of the evergreen revolution and related things is a matter of common sense. It’s the farmers’ wisdom combined with scientific technology. Farmers have always been concerned with sustainability. That is why they selected, for example, fertilizer trees. You and I didn’t select them, they were selected by farmers; fertilizer trees in Senegal were selected by farmers. Therefore, the farmers’ own experience – they have experience because day in day out they work with life; they work with the sun and the rain. Therefore, I think you must be sure that the evergreen revolution is very simple: Whenever you do

something, in your own world you must aim at sustainability. All of us have salaries and money and we manage that sustainably, otherwise we would become bankrupt. The same is true with land and water. Biodiversity - that word means evergreen revolution, sustainable agriculture. It is what farmers want. Otherwise they will all talk about organic farming. Again, in your country, there has to be this transition from purely patronage to partnership with farmers otherwise it won't work.

ISTA seed quality and quality literacy have become very important. Today with modern information technology, a lot of educational tools are available. We have science centers in India which try to promote quality literacy. The Chairman of the National Commission of Farmers of India recommended that on an outstanding farmers' field, where somebody is producing outstanding quality, we should put a dormitory/hostel to allow other farmers who want to take up activities to learn from him. For example, it may be for tissue culture for bananas. Farmer-to-farmer learning has high credibility for the simple reason that farmers in my country believe other farmers from an economic point of view. They don't believe the agronomists because they think they are underestimating the costs and overestimating the income. Therefore, they believe in the farmers' own economics.

Emergency help is always in terms of food aid when people are starving because they need food today, not tomorrow. But what you mean by giving genes, this is what I call pre-breeding and participative breeding with farmers. Whichever genes are important for the country, those must be made available. This is where the multilateral system of exchange in the case of IT PGRFA is important. Some methods which we have now developed at the request of FAO are to elaborate guidelines for genes for helping people to overcome the impact of climate change: genes for adaptation to climate change. In fact, that is what I pleaded in my Science editorial. This can be done and they have to be given to people who are competent to convert them into local varieties. When you face new situations, you need new responses, and I hope the forthcoming summit at FAO will indicate some measures by which to address this issue. Please remember my message – I think the green revolution will not happen unless you have affordable technology, reliable technology, low-risk technology, to provide the services by which good quality seeds are available at the right time, water, electricity, etc. You have the price mechanism – input/output pricing, so that the economics are right. In my own country, in spite of all of our talk, the National Sample Survey Organization of the Government of India took a survey of farmers: 45 per cent of those interviewed said they would like to quit farming if they had other options. In my country, 75 per cent of the population is below the age of 35: young people. How am I going to attract and retain this youth in farming if their own parents want to quit farming? That is why my last point on farmers' enthusiasm comes only if farming can give them a reasonable income.

CONCLUSIONS OF THE EXPERT FORUM

Session 1 conclusion, presented by the Chairperson, Mr. Orlando de Ponti

The role of plant breeding in meeting the multiple challenges of a fast-changing world

- ▶ Improved varieties and high quality seeds are basic requirements for productive agriculture, which is the basis of sustainable economic development in developing economies
- ▶ Through the efforts of both the public and private sectors, plant breeding has provided an enormous contribution to global agriculture (yield, resistance to biotic stresses, tolerance to abiotic stresses, harvest security, quality traits including nutritional value, etc.)
- ▶ Plant breeding has the ability to significantly contribute in solutions to several of the challenges ahead such as food security, hunger alleviation, increasing nutritional values, and higher input costs. Plant breeding and related disciplines and technologies help in mitigating the effects of population growth, climate change and other social and physical challenges
- ▶ Intellectual property protection is crucial for a sustainable contribution of plant breeding and seed supply. There are still many tools and traits in the pipeline that will prove to be very necessary for the continued supply of high quality varieties and seeds
- ▶ Apart from genetic enhancement, other technologies, e.g. quality seed production and seed treatments, contribute substantially to improved seeds, and capacity building in all these areas is urgently needed in developing countries.

Session 2 conclusion, presented by the Chairperson, Mr. Bert Visser

The importance of plant genetic resources for plant breeding; access and benefit sharing

- ▶ Plant breeding and the sustainable use and conservation of genetic resources are interdependent.
- ▶ The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) is a unique and innovative legally binding instrument providing facilitated access to genetic material for plant breeding at the international level
- ▶ The Multilateral System (MLS) of the ITPGRFA provides a consistent Access and Benefit-sharing option for plant breeding activities
- ▶ The Standard Material Transfer Agreement (SMTA) of the ITPGRFA is a contract between the provider and the recipient that is simple to use and facilitates access to germplasm
- ▶ The involvement of the private sector in the design of Access and Benefit-sharing schemes is necessary for a well functioning Access and Benefit-sharing mechanism
- ▶ Material in the MLS is a source of genetic traits and characteristics of interest
- ▶ The full success of the ITPGRFA and its MLS will depend on local, national and regional implementation, as well as on the availability of funds at the local, national and regional level.

Session 3 conclusion, presented by the Chairperson, Mr. Doug Waterhouse

Plant Variety Protection

- ▶ The number of new varieties increased after the introduction of plant variety protection.
- ▶ Introduction of the UPOV system of plant variety protection was associated with increased breeding activity and with the encouragement of new types of breeders, such as private breeders, researchers and farmer-breeders. The introduction of PVP was also associated with the development of partnerships, including public-private cooperation.
- ▶ Introduction of plant variety protection was associated with the development of new, protected varieties that provided improvements for farmers, growers, industry and consumers, with overall economic benefits.
- ▶ One of the benefits of plant variety protection is to encourage the development of new, improved plant varieties that lead to improved competitiveness in foreign markets and to development of the rural economy.

- ▶ Membership of UPOV was associated with an increase in the number of varieties introduced by foreign breeders, particularly in the ornamental sector.
- ▶ The breeder's exemption, whereby protected plant varieties can be freely used for further plant breeding, is an important feature of the UPOV system which advances progress in plant breeding.
- ▶ Access to foreign plant varieties is an important form of technology transfer that can also lead to enhanced domestic breeding programs.

Session 4 conclusion, presented by the Chairperson, Mrs. Katalin Ertsey **The importance of quality seed in agriculture**

- ▶ The session demonstrated the importance of seed quality for crop productivity and agricultural production. It has underlined, that a lack of information on seed quality could result in crop failures and has the potential to threaten food security for whole countries
- ▶ The determination of seed quality parameters requires a broad knowledge of plant and seed physiology, taxonomy and botany and requires intensive scientific studies and research
- ▶ The application of seed quality evaluations requires a detailed knowledge regarding seed production, seed marketing, seed regulations and the seed sector
- ▶ Since 1924 the International Seed Testing Association (ISTA) has been the impartial and objective platform where leading seed technologists and researchers have come together to discuss relevant scientific progress and make the necessary definitions regarding seed quality and how to measure it
- ▶ Currently in developing countries there is not an adequate seed quality assurance infrastructure with respect to seed testing and this is required to increase crop productivity and provide enhanced food security in these countries
- ▶ The evolution of seed quality determination has not reached an end point and there are interesting developments in the pipeline that take account of the changing needs of the market. These will make tests and their applications more relevant, effective, robust, quicker and cheaper
- ▶ Significant cuts in scientific research and education has reduced the possibility for young academics to acquire the necessary seed technology skills
- ▶ In the seed technology area transparency in and scientific exchange of the latest research results remain of crucial importance for continued progress
- ▶ Uncompetitive salaries for seed analysts in developed countries make a career in seed quality control unattractive for young people.

Session 5 conclusion, presented by the Chairperson, Mr. John Kedera **Facilitation of trade and market development**

- ▶ Global seed market has grown rapidly in recent years and is currently estimated at about US\$37bn. Europe, North America and Asia account for almost four-fifths of the global seed trade. For 2007, the international seed trade was estimated at US\$ 6.4bn
- ▶ The use of international certificates for varietal certification, phytosanitary measures and laboratory testing has greatly facilitated the development of the international seed trade
- ▶ Production and marketing of certified seed of all agricultural crops is highly regulated at both the national and international level. A transparent and efficient regulatory system is crucial to ensure that farmers have access to high quality seed at a reasonable price
- ▶ The international regulatory framework consists of certification based on varietal identity and varietal purity (OECD, AOSCA), phytosanitary measures (IPPC, WTO-SPS, NPPO), plant variety protection (UPOV) and seed testing (ISTA, AOSA, etc.)
- ▶ Regional seed regulatory frameworks have been developed and harmonised to facilitate regional trade e.g. Central America, Mercosur, EAC, SADC, ECOWAS, etc. Regional standards, such as those of the EU, are closely aligned with international standards such as those of the OECD and clearly set out the registration and certification conditions for the marketing of seed
- ▶ The increasing use of harmonised international certification procedures on varietal identity and varietal purity helps to facilitate the import and export of high quality seed by assuring consumer confidence and reducing technical barriers to trade

- ▶ Good cooperation between the public and private stakeholders in developing and setting standards that are internationally acceptable has facilitated the issuing of certificates which, in turn, has contributed to the growth in trade
- ▶ Implementation of measures to prevent the introduction and spread of plant pests is critical to ensuring the development of a viable and sustainable global seed market. The International Standards for Phytosanitary Measures (ISPMs) provide useful guidance on the application of phytosanitary measures to the international seed trade.

OVERVIEW OF THE EXPERT FORUM

BERNARD LE BUANEC

Ladies and Gentlemen,

As I said during my opening address last Tuesday, we showed during the First World Seed Conference held in Cambridge in 1999 how new plant varieties and quality seed were important to meet the challenges humankind was facing to ensure environmental sustainability and food security. Today, 10 years later, those challenges persist and have even intensified with an increasing realization from all countries in the world of the need for food security in the context of climate change. The food crisis of two years ago showed that food production levels are on a knife edge and vulnerable to weather fluctuations and government policies, with a significant impact on food availability and prices world-wide.

The population continues to grow and, according to UN statistics, should grow from 6.8 billion people today to a little more than 9 billion people in 2050. The food demand will increase dramatically due to quantitative, but also qualitative needs. To meet that food demand, it is generally recognized that crop production will have to increase by more than 50 per cent over the next 20 years. The level of urbanization will reach almost 70 per cent in 2050 from around 50 per cent this year, putting more pressure on each farmer to feed the urban population. Meanwhile, the arable land area per inhabitant will continue to decrease from 0.25 hectares today to 0.15 hectares in 2050. In addition, the decision by many governments to encourage the production of third generation biofuels requires more crops to be produced. The only solution to meet those challenges, and that was said this morning by Prof. Swaminathan, is to increase significantly the productivity of each hectare of cultivated land.

In this period of concerns about food prices and food security, FAO, OECD, UPOV, ISTA and ISF considered that it was timely to organize this Second World Seed Conference with the objective of identifying the key elements necessary to ensure an enabling environment for the development of new varieties, the production of high-quality seed and their delivery to farmers.



Source ISF

You see now five maps (see Fig. above): four maps represent the members of the ISF, OECD Seed Scheme, ISTA and UPOV. In the middle you have a map from the FAO website showing the hunger map in 2005. Of course, it is not possible to make a direct link between the level of hunger and, as

you see, the absence of those countries in all the seed organizations. Such a direct link would certainly be inappropriate. However that observation certainly deserves more thought, taking also into consideration other important factors.

I hope that the result of our Conference will help to answer some of the questions.

Now I am going to summarize the conclusion of each session:

Plant breeding has significantly contributed and certainly will continue to be a major contributor to increased food security whilst reducing input cost, greenhouse gas emissions and deforestation. In that way, plant breeding significantly mitigates the effect of population growth, climate change and other social and physical challenges.

The International Treaty on PGRFA is an innovative instrument that aims at providing food security through conservation, as well as facilitated access to PGRFA under its multilateral system, called MLS for Access and Benefit-sharing. The MLS represents a reservoir of genetic traits and therefore constitutes a central element for the achievement of global food security.

Intellectual property protection is crucial for a sustainable contribution to plant breeding and seed supply. An effective system of plant variety protection is a key enabler for investment in plant breeding and the development of new varieties of plants. A country's membership of UPOV is an important global signal for breeders to have the confidence to introduce their new varieties in that country, thus facilitating technology transfer.

Seed quality determination based on scientific principles before supplying the seed to farmers is an important measure for achieving successful agricultural production. The establishment and maintenance of an appropriate infrastructure on the scientific as well as the technical level in developed and developing countries are highly recommended.

Finally, the development of readable and internationally acceptable certificates for close collaboration between all stakeholders along the supply chain for varietal certification, phytosanitary measures and laboratory testing contributes substantially to strong growth in international trade and the development of seed markets.

So those, ladies and gentlemen, are the conclusions of our expert forum and I hope that it will give you food for thought for the coming months and years, but before that, food for thought for the panel discussion which we are going to have now.

Thank you for your attention.

PROVIDING AN ENABLING ENVIRONMENT

PANEL DISCUSSION

PETER LATUS (FEDERAL OFFICE FOR AGRICULTURE, SWITZERLAND): I want to bring the discussion to a question that we still haven't discussed. The last two days we have heard about dying breeders, we have heard about soon-to-be-dying baby boomers, something I don't wish for since I'm one of them! I want to raise the point of the danger of the possible dying out of very successful variety listing and seed certification systems in what we call developed countries, such as Switzerland where I come from. Why do I have this concern? I have this concern because variety listing with us and EU recommendations are being seen more and more in our countries, especially in the German-speaking area, as an instrument to avoid diversification in plant production for small markets who want to increase products by adding local varieties, old varieties, old foreign varieties, or any material. For us, we have already been having this discussion for six months; it is very difficult to sell the advantage of a very successful system, variety listing certification, to the public and to the policy makers. They ask us why we want to protect farmers from themselves if they want to store uncertified material from that material. I want to ask the panel: What do you think about the challenge for all of us to enable the production, to introduce a system for the production of these "out-of-the-system" varieties and to keep the seed certification system and to respect plant protection recommendations? I think in our developed countries that will be a very important question over the next few years.

ORLANDO PONTI: To start with the first part of your question, we were also discussing yesterday that we might have a problem of succession in industry and also in the public environment in seed certification, plant variety protection, etc. Yes, there is a problem and I think worldwide we share your concerns. It is not just in developed countries, but also in developing countries. I can tell you, from my close involvement in the Netherlands, we have been trying to manage ways to get more school kids into what we think is an exciting profession. However, the problem is that, because we are innovative we like it, but it seems that it is very difficult to bring that to the understanding of those who are still at the beginning of a career. I would like to mention one thing that we did very recently and it seems to be quite effective. We have to admit, if you look at the figures every year, that over the last 10 to 15 years, the number of new students coming into agriculture in general, including plant breeding, plant protection agronomy, is extremely low. We have noticed in our country that there is a steady and stable number of new students going into biology. That is very interesting because agriculture is based on biology. So what we did this year is we organized a one-week summer school in the Netherlands, with Wageningen University, Plantum and the National Seed Association, and we invited bachelor students who were already in some way involved in biology and we communicated with them through a very active program, both academic and with excursions, saying: "Look, here is a field of industry and the environment around, that is very exciting. So you are midway in your academic training and maybe you should make a small move and move in the direction of the field of plant breeding in all its aspects." What I got back from the summer school is that it was successful, but we have to see how many of those students now make the final decision to say: "I'll go in another direction and I'll go in the direction of the plant industry". It is not easy at all, but I think we have to work very hard on it around the world because we need competent people in order to manage and to work in this important business.

BERNARD LE BUANEC: I think that the question was also on the need or not of [Value for Cultivation and Use] VCU and registration and cataloguing at national level. I would say that that is a mainly national issue rather than an international issue, so I would probably transfer that question for discussion to national level. What I can say is that you have in the world many different systems and you have systems where you have registration and VCU very strongly regulated, and you have countries where you don't have any catalogue at all. Experience shows that there is no link between the system you are implementing and the quality and success of agriculture. It is mainly a national issue, and I know countries where you have no VCU, no catalogue, with very efficient agriculture and the same with a catalogue, so there is no link there. I would suggest that you discuss that at national or regional level, but not probably in this forum.

ROLF JÖRDENS: As a representative of the International Union for the Protection of New Varieties of Plants (UPOV) here, a *sui generis* system of plant variety protection, it is perhaps important to note that the UPOV Convention clearly states that this system of plant variety protection is independent from market regulations. This *sui generis* system of plant variety protection can stand on its own and can be very successfully operated and implemented independently; it must even be implemented independently from market regulations.

WAYNE JONES (OECD): The comment came from the question on why we would want to protect farmers from themselves. If they want to use uncertified seed, let them do so. In our work with developing countries, which we often do jointly with the FAO, quite often what we find is that there are simply no functioning input markets in some of the least developed countries. It is not a question of farmers making a choice; they have no access to seed, to fertilizers, to credit. One of the first rules in terms of development that we have come across in our many years of experience in different countries, in different contexts, is that governments need to move with the private sector and also with the international agencies and develop those input markets. Otherwise there is simply no access, particularly for smallholders, to things like certified seed.

THOMAS OSBORN (FAO): I would like to reinforce what the others have said, that these systems in many developing countries need to be strengthened. But at the same time, we also need to bring up your point about what farmers are using now; we need to have greater knowledge of the traditional varieties and the varieties that farmers are using now. This is very important in terms of the conservation and use of germplasm that we will need for the future and if there are emergencies or other activities, or the need for transferring between different agricultural zones. There is also the formal sector and the formal variety registration system, but we need to know more about the informal system, so it can feed into other work and other needs for the future.

BERT VISSER (CENTRE FOR GENETIC RESOURCES, WAGENINGEN UNIVERSITY AND RESEARCH CENTRE (NETHERLANDS): My comment is on the same lines. You suggested in your question that there is a contradiction between the need or the desire for variety listing as we know it on the one hand, and requests from farmers and farming communities for more options to grow traditional varieties on the other. I do not think that there is a contradiction. Within the European Union, there has been a first attempt, I think, to combine the merits of the two systems by the introduction of new legislation which is called the EU Directive of Conservation Varieties. Although I personally think this is still not an ideal Directive, it is at least a first step in the right direction and it shows that the two systems, a variety listing for released varieties from the formal sector and more room for the maintenance of traditional varieties by farmers, can be combined.

FRANÇOIS BURGAUD (GNIS, FRANCE): This morning we were reminded, as we were now by Prof. Swaminathan, that last year the food crisis brought home to the international community once again the importance of agriculture and in the development of that agriculture, the importance of seeds. One could be led to imagine that there would be new hope for developing this sector in order to, once again, encourage development. And yet there is an important risk factor and I would be interested to hear the opinions of the panel who are heads of international organizations, on the concerns that I would like to raise. The timeframes in which governments work are not the same as those used by agriculture or the seed industry. Over the last two days we have heard many speakers say that the time for selection for the creation of new varieties is long – seed production takes time, it takes several generations and, therefore, the moment of identifying and developing a new variety suitable for the farmers and the moment that that seed is made available to the farmer generally takes several years. The programs that we have heard about over the last year, for example from the representative of FAO who spoke of the 300 million euros given by the European Community to undertake urgent seed projects, are not going to resolve the question of developing the seed sector in developing countries. So there is a real risk here in that there might be a decline in interest by the international community once again and it is more than likely that the way the money has been invested will not have served any purpose. I would like to understand whether this feeling is also shared by members of the panel and, if so, what does our panel think can be done by the international organizations represented here to help politicians understand that the timeframes of the seed industry and farmers are not the same as theirs and, secondly, that in my opinion, we should make them understand that between the poor smallholder and agricultural research, as Prof. Swaminathan said this morning, there is a whole sector, the production and commercialization of seed, that we have seen over the last two

days is essential, and is very often forgotten in urgent operations and international projects. The representatives of the African Seed Trade Association reminded us several times yesterday that they had found it extremely difficult to find assistance.

BERNARD LE BUANEC: Just a quick correction and then I will ask the panel members to answer. During our discussion yesterday and the day before the term “long-term investment” was used several times and that is part of your concern. Who on the panel is willing to react on that topic?

XAVIER BEULIN: I don't want to answer this question directly because I think that it concerns the difference between investment in emergency situations and medium- and long-term investment. Representing my organization, I can tell you speaking for farmers worldwide, we are against emergency aid. Not food supply, but we are concerned about the impact that emergency aid can have on investment in agriculture, in particular in seeds. I would like to add to what François Burgaud said: how can you imagine in the southern part of the world, farmers who year after year are subject to volatility without any compensatory mechanisms, without any safety net, how can you expect them to invest in the medium to long term in the production of seeds? How can you imagine that this investment can be made? It is simply not possible. So I think that there is need to rethink the situation. I remember that last year at a Conference organized by FAO in this same hall we heard very radically opposed ideas; some governments came to say that what was important was to invest in emergency aid to deal with a crisis and other governments said that we needed to put an end to that and dedicate these resources to investment in the medium and long term and in particular investment in production factors, and of course seed is at the top of that list. I could add a third element. This raises questions for the seed companies too. Because if we don't have public/private mechanisms facilitating access to quality seeds, then it is very difficult to imagine that the stakeholders themselves can respond to the medium- to long-term difficulties in their seed production. So we need to have an intelligent combination of public policy enabling medium- to long- term investment with the private sector. Here of course we also have the will of the seed associations and companies in particular if they need to be able to meet the challenges, particularly at local level.

JOHN KEDERA: I think we have also made an assumption that the politicians understand the complexity of the issues that we deal with in seed. I believe that we need to start creating real awareness on the issues, because we make an assumption that they understand and when they make a decision, they make a decision that is based on political experience, not on the right decision that will help the seed industry or supply of seed to the farmers. So I think there is a need to create awareness.

WAYNE JONES (OECD): What is probably amazing is not the political response to the food crises, to the 1 billion plus that are now in hunger, but the fact that there have been 800 million plus in the same situation for decades and nothing has been done about it and the numbers remain the same. What happened with the food crisis, the rise in prices was just a wake-up call and I think we are very lucky that governments now see it back on a political agenda at the international level. I think there's a strong recognition that something needs to be done, but the same question that was posed is: What? What do we do and how do we do it? That is much more difficult to answer. Clearly, a large part of the food security, or insecurity, problem is poverty. The solutions lie outside agricultural development in a sense; other than making the point that many of those in poverty are also in agriculture; they are already farmers. What I think the OECD's six-point plan would be, what we have found is for those countries that have been able to make vast improvements in the reduction of hunger and poverty, they first got the basics right. They have introduced good governance and this is fundamental. Virtually nothing else can proceed until you have a reliable and transparent business environment. Then you need to take (which we saw with the green revolution) a very comprehensive approach: that is there are many factors, many of which were listed this morning, and dealing with just one of those, whether it's research or input markets, or developing the market, making sure farmers receive a return; there is a long list that was already mentioned this morning. All of those factors need to address something in order to have a successful outcome. Public goods – this is something that we think of in many of the countries that moved into a system of privatization. Many of the institutions and infrastructures which were maintained by governments in parastatals suddenly disappeared, particularly in developing countries, and they were left without the kind of input markets that the people need. That needs to be revisited. Research and development is clearly important, but what was mentioned this morning is the importance of linking international developments with local needs. In particular, in devel-

oping countries there is a need to bring this kind of research and productivity to the smallholders. I think that is what is being developed now. Last, but not least, was a point that was made by several people this morning that we have to move away from this patronage and much more into a partnership arrangement; a kind of Paris Declaration attitude that the international agencies need to work in partnership with the individual countries. I think if there is one message that we would like to give it is that you people, as already mentioned, form part of a huge industry: 6 to 7 billion US dollars in international trade. You have a serious voice in the world of agriculture and trade policy, at least you should have and I would encourage all of you to ask yourselves how are we being engaged in the policy debate and how can we do a better job of that. That is something maybe for the next Conference.

THOMAS OSBORN (FAO): FAO certainly agrees 100 per cent on the crisis: our DG raised the alarm at the end of 2007. Of course a part of that was a short-term response in productivity safety nets to help vulnerable farmers produce more food, but also, certainly on the technical side, with our partners to look at more medium- and long-term initiatives that were needed. This was followed by the food summit last year and one that will be held this year, and even the purpose of this meeting is to bring attention to the issues related to seed. Part of that was the development of the UN Comprehensive Plan of Action, that's not only FAO, but FAO working with all the other UN agencies relating to the food crisis and what really needs to be done in the short, medium and long term. The other thing I would like to mention, that Prof. Swaminathan mentioned, is that we are not just talking about seed, and where we are clear when we give our technical message is that it's about looking at inputs of seed, fertilizer, credit. It's looking at improved production systems, organization of farmers, irrigation, this kind of issue, and then the market, linking farmers with the market. If you just improve the seed without looking at the rest of the system, you are not really going to achieve your objective. The last point I would like to make is that FAO is certainly committed to working more effectively with the private sector and this has been part of our response related to the soaring food price issue. There have been a number of forums and discussions with the private sector and we certainly see the private sector seed industry as very important partners for getting the technologies, the improved varieties, which are needed throughout the world out to farmers so that they can get higher levels of production.

MICHAEL MUSCHICK (INTERNATIONAL SEED TESTING ASSOCIATION (ISTA)): My feeling is that if we are talking about a long-term strategy we also have to talk about knowledge: knowledge transfer and also communication. We need to transfer the knowledge we have in the developed world to the developing world and we need to build on the knowledge we have currently in the developed world and to strengthen it. But the real situation in fact is that we are reducing capacity; we do not have sufficient capacity in the developing world and we are reducing capacity in the developed world. So I think that this is definitely a point that we have to be aware of and we have to take into consideration.

ORLANDO DE PONTI (PRESIDENT, ISF): I would like to follow up on the issue of good governance and a transparent business environment because we have to be aware, whether we like it or not, that plant breeding is a slow process, for the simple reason that it takes generations. But there is a means of speeding it up and that is what we call shuttle breeding. If you are able in your breeding program to do one generation here another generation there, from one hot spot to another using the two hemispheres, you can speed up the program. The problem is that in many countries, if you do this, your seed sits for weeks or months at the customs. As Dr. Jördens mentions, if governments moved into good governance and an efficient and transparent business environment, there is a very simple means of speeding up the breeding program. We cannot do it because we have to stick to those rules and, quite often, we have major problems for this type of activity. That is what I call the regulatory environment, which is very important for the breeding industry because, for good reasons, we are bound by many regulations but please make them as efficient and effective as possible.

ROLF JÖRDENS (VSG, UPOV): I think over these two days, it has become very apparent that we need to create an enabling environment for creativity. We need to have clear and simple legal systems under which creativity is encouraged. Initiatives of thousands of people, perhaps millions of people need to be activated and that is indeed the approach on plant variety protection according to the UPOV system. It is a straightforward system, which can relatively easily be transferred into a national law and, through cooperation, it is also easy to implement and thereby private initiatives and also public initiatives are encouraged. There is not very much public investment money required. We don't speak here of millions or billions of dollars; it is a relatively cost-effective approach – that is an element of good governance.

BERT VISSER (CENTRE FOR GENETIC RESOURCES, WAGENINGEN UNIVERSITY AND RESEARCH CENTRE (NETHERLANDS)): On a slightly different note, one of the panelists mentioned that many of the people in poverty are farmers. I think one of the options, and I think we need a multitude of options to deal with the food crisis, is to make these farmers and these farming communities more autonomous in their food supply and in providing their food security. I think that Prof. Swaminathan rightly mentioned the enormous importance of more participatory approaches. They assume not only that there is technology transfer from developed countries to developing countries and from breeders to farmers, but also vice versa, because there is a lot of knowledge of local systems, of local situations, among the farmers that must be used, exploited. I think that if we can make farmers more autonomous in that way, by giving them better access to genetic materials, including from the private sector, by providing them with knowledge to help them to cross and select for their own purposes and for their own markets, then we will also improve the food security of the farmers. It doesn't mean that the private sector in those cases is less needed. On the contrary, because "participatory" implies that there are different parties working together and I think that is the ultimate form of public/private partnership that we need in this respect.

BERNARD LE BUANEC: I am not sure that we really have the answer to a need for long-term investment, but obviously we are all in agreement that the question will be how to convince governments to make long-term investment. Before giving the floor to your questions, I would like to make a comment regarding the importance, in terms of money, of the seed industry. It has been said that it is a large industry, a significant industry and that we have a 37 billion US dollar turnover. But that is nothing. If you compare the seed industry to the value of agriculture at the farm gate, it is 370 billion US dollars and if you compare that to the turnover of the agri-food business, it is 3700 billion dollars. So the seed industry represents 1 per cent of the turnover of the agri-food industry. We are essential, but unfortunately, we are not important enough to be able to lobby governments efficiently. That is something we have to bear in mind.

IR. HINDARWATI (DIRECTOR, CENTER FOR PLANT VARIETY PROTECTION, INDONESIA): My question is to the OECD. As I learnt from the presentation yesterday, it is important to ensure quality of seed and therefore you think the same standards are very important: the OECD Scheme is important, but membership is just for governments. I think the participation of the private sector is important to support governments in membership of the OECD. My question is: Do you have any strategy to attract governments to cooperate with the private sector to join the OECD? But I have one suggestion to add: I suggest that we have some statement to cope with the challenges of changing the world, we need acceleration of new variety generation by focusing on varieties with important traits and less input using genetic resources as a main national investment and biotechnology as tools to engineer plant breeding. Therefore, public/private partnerships achieve an acceleration of new variety generation with a win/win solution using intellectual property and plant variety protection as a tool to protect the technology used and for new varieties. That is my suggestion to add to your conclusion.

BERNARD LE BUANEC: First of all thank you for that and could you perhaps make a written proposal?

WAYNE JONES (OECD): Very briefly, before I ask my colleague, Michael Ryan to comment on OECD strategy, because the Seed Scheme does have a strategy in development. But I can't let Bernard go because he is maybe too conservative on the importance of the seed industry. Maybe the dollar figures aren't the right ones to use, but in the FAO's work that they are doing now on how to feed the world to 2050, they have held some technical and expertise sessions such as this one and in one of the reports (at least I hope I'm not misquoting FAO research), they are arguing that at least half of the expected productivity gains in the years leading up to 2050 are going to come from seeds. And that has got to be a huge hammer with which to hit politicians in terms of the importance of the seed industry and the importance of a regulatory environment that can help them move ahead. One of the comments I would like to make on your proposal is what I heard this morning from a couple of the speakers. The importance of using the full buffet of research that is out there: biotechnology, genetic transfer to decide what is best for an individual crop in an individual country. I think it would be wrong to partly close the door on any one particular avenue of research when we look at the kind of increase in production that we need over the next several decades. Could I ask Michael Ryan to make an intervention?

MICHAEL RYAN (OECD): Thank you for that question. I think the first part of the question related to governments that are not already involved in the OECD. In the OECD we have an enhanced engagement strategy at the aggregate level and Indonesia is a member of that group and that is part of the outreach work that is taking place with non-OECD members. On a more specific level, the strategic plan which I mentioned yesterday also has a component that is looking at further developing linkages with non-member countries or countries that are not yet members of the OECD Scheme. As part of this outreach work, at the 2010 Annual Meeting, we will have a special workshop that will focus specifically on the Asian region and this workshop will be held in New Zealand in March 2010. We will invite as many countries as possible from the Asian region, OECD Seed Scheme members and non-members and we will have a chance to discuss this a little bit further at the APSA meeting in November 2009 in Bangkok. On the other issue, there was a question related to the involvement of industry in the work of OECD. Yesterday, I mentioned that industry can have an influence in two ways: one is through the formal approach to government representatives and the national designated authorities. But there is also an approach where industry and companies can take part through the BIAG Committee (Business and Industry Advisory Group Committee) that meets regularly with different committees within OECD and shares concerns, information and discusses the position of the industry and also possible solutions to emerging problems in the sector. So there are a number of ways of linking the industry and the private sector with the policy work that is currently taking place in OECD.

BERNARD LE BUANEC: I will just add that also, for cooperation with industry, ISF is a permanent observer in the OECD Seed Scheme. It is extremely important for the seed industry.

JEAN-LOUIS DUVAL (JLDUVAL CONSULTING SARL, FRANCE): I would like to come back and continue a little bit on what François Burgaud raised. It will be about long-term and short-term investment, because I am in the field scene now, having been for seven years in the developing countries. I will say about long-term investment that, yes, we have heard that it is more sexy to train PhDs for our future and for creating new varieties and we need some. However, the issue will remain when the varieties are arriving from those programs, and what I have seen is, in the short term, the availability of seed is here, but it is not used. The germplasm is available but even, you know we speak about PhDs, but to do good screening just to test the variety in the field, in many places it is not done. So when the new variety arrives in 15 years, we will have to address the same issue in a certain way, and I will take the words of the remunerative market for the farmers: How can we address this issue with a more comprehensive approach where the logistics, the important aspects I have seen so much of and that when the seed company wants to develop the variety in a new country, it is obliged to give the seed free because the farmer is unable to purchase it? So the question of credit for farmers seems to me a very limiting factor. So could we ask the panel if they have the same view of these limiting factors and how would they balance the need for investment between the long term and the short term?

ORLANDO DE PONTI (PRESIDENT, ISF): I think this is an excellent and very relevant question because, yes, I mentioned it before, whether we like it or not, plant breeding takes time and the problem is now. But I very much like your comment asking what about the current varieties. If you have a problem in a particular country where you would like to have better varieties, better seeds, be aware that hundreds of thousands of varieties are around. I think what you are also indicating is to test what is available. Variety testing is a very important and a very powerful means for the short term; variety testing by the farmers. You have to manage it but it is a low-cost activity. Very clear indications are needed of how to do it in a proper way so that you know for a particular country, and you can collect varieties from around the world from comparable climate zones and you find out what is the variety or varieties which are best suited. Then the next step is to have them multiplied and taken to the farmer. It is a very effective short-term activity and it has been overlooked for the reasons you give – yes, it's more sexy to do something new and then it takes 10 to 15 years, so start with what is available. You can only sell the seed that you have in your warehouse; you cannot sell the seed that you still have to breed!

THOMAS OSBORN (FAO): It seems to me that one of the elements you are bringing up is the weakness in national seed systems, and when we say national seed systems, that includes research, the seed companies, the private sector, the farmers, the national seed services, the policy makers. One of the ways to start to look at how you can improve the linkages between all these stakeholders in the seed sector is through a national seed policy formulation or reformulation process that brings all those

stakeholders together and moves that process ahead. Now, of course, that is not the end of the issue at that point in time, but in the follow-through they come up with a seed policy that they themselves have developed with help from FAO or others. This is a first step in addressing some of these issues. This is one of the issues that came up in our private sector discussions earlier this year.

WAYNE JONES (OECD): I think you raised the point that I ran over very quickly and that is, there is more and more focus now on trying to develop these input markets for seeds or fertilizers, even for credit. I think we are a long way from having effective systems in most developing countries, but there is a focus on that. There is much less focus on developing the output markets, the marketing systems, which also need to be in place. A number of people have mentioned the fact that even if they have access to these, farmers will not introduce them if they don't have the revenue or the means with which to buy them. Even if they have the credit to buy them, they may still not because there are no risk management tools available to them. They have no crop insurance, they have no social safety nets and the market is highly volatile. Something has to be done there. A perfect example of what not to do happened with the rising prices in 2007/2008 when, for the first time in many of these countries, prices went to a level where the smallholders could actually start to look at some positive income. So what did many governments do? They introduced export restrictions so they couldn't participate in the higher prices; they introduced import tariff reductions and they increased local competition, so again the economic rent that the local small producers could have received was lost to them. The OECD message which is very important is to keep international markets open in this case and let farmers benefit from those times when prices do go up.

JOHN KEDERA (KEPHIS): Just to add to what has just been said is the whole element of how agriculture has been approached in most of our countries. It has tended to be more social welfare. Farming, because it started raining, or because your neighbor planted and that kind of scenario. There is slowly a shift toward making agriculture a business even when new companies come in. If I were to give the case of Kenya: in 1978 it was very hard to talk about many companies in the country, but now they are slowly coming in. The other expectation was that a big company would come into Kenya and jump into the fray and have a larger market share. You have to go in and learn the art of how business is done in the country and that kind of scenario. It is not what should be encouraged, but it is the system to enhance and allow the farmer to produce. So the partnership that is being talked about between the private sector and all elements of credit and the rest is what needs to be looked at at policy level.

DOUG WATERHOUSE (AUSTRALIA): I would like to pick up on the two points. Certainly, the message has to be to policy-makers for some sort of integrated, comprehensive, cohesive system. However, and I think that John Kedera has pointed to this, and so has Wayne, I don't want the public sector to go to sleep. I think that they have a very important role, particularly in the input markets. Wayne talked about the lack of risk insurance and this is part of the role of private industry to start to share with the farmers that risk and to develop business models that work with farmers so that the industry receives its remuneration when the farmer also produces a successful crop, the so-called end-point royalty type of model. There are lots of different implementations of this; ways that private industry can, not just partner up with government, but also partner with the real partners here, and that's the farmers. I would strongly encourage the development analysis of these sorts of different business models in countries where they haven't been tried so far. It works effectively in some developed countries, such as Australia, but certainly it looks like it could also be worth investigating in the sort of situations that we are talking about here.

RAOUF GHARIANI (PRESIDENT, BADDAR AGRICOLE, TUNISIA): For the last few days we have talked of many interesting things for our work. It would like to speak as the professional I am from a country where today we have a number of investment opportunities in the seed sector and I would like to make some comments and also raise some questions on aspects of major concern for the future of breeding activities in a country such as Tunisia. Our market is a small one; we have a population of 10 million, with important markets in neighboring countries with a strategic location, however, unfortunately the rules implemented by the neighboring countries make trade in seed very difficult, if not impossible. Seed circulating between Tunisia and Libya, for instance, is treated as a product of contraband. The rules are hard to abide by and in order to carry out sustainable investment activities it is very difficult, even though there are quite some opportunities. On the other hand, we have over the last two

days talked at length about efforts by international and national bodies responsible for the seed sector and many of the views and positions expressed here are not, in my opinion, relevant in the exercise of my profession. I see many rules and regulations, but there is a good deal of muddle at the end of the meeting, because I would like to respect the rules but when I see that the FAO has its own rules, that ISTA has its own rules, that you have to be a member or be accredited to ISTA, that I have to make a large investment to become an accredited laboratory to meet international standards, I think that now is the time, after a meeting like this, to look a little more closely towards countries such as mine, where we have the possibility of doing specific activities, because we have a certain ecotype, we have commercial opportunities, we have a history in the industry. It is unfortunate that we continue, with so much work done over the last few years, and I am grateful for all the efforts made by everyone, but I think at the same time, we should be looking towards certain countries, and I had the honor to be President of the Association africaine des commerces des semences – and I saw the difficulties that African seed companies had in exchange, first between themselves and then to set themselves up as seed companies following international practice. It would be easy to continue commerce from the North to the South, but we have the ecotypes, we have the material and we have possibilities. We have skilled manpower, and apparently it will be skilled manpower that will be lacking, that's what one of the sessions over the past few days stated. Why are we doing nothing to make the processes a little more practical in the field in our counties, so that investment can be something palpable and concrete? Farmers are requesting high quality seed. Where will we be in several years if we continue to talk without taking any decisions?

THOMAS OSBORN (FAO): I want to acknowledge the speaker from Tunisia. We had a meeting in Tunisia related to seed, but more related to wheat rust a few months ago. I think Tunisia and the North African countries do offer a lot of potential because of the markets they have, the level of development, the vegetable industry and the level of agricultural development. At the meeting that we had there were four of the North African countries represented: Tunisia, Libya, Morocco and Algeria. FAO has been involved, with our partner organizations in activities to harmonize seed rules and regulations between countries in Southern Africa a while ago, but more recently in the ECOWAS countries of West Africa, and COMESSA is now requesting a similar kind of harmonization activity to increase the trade of seed between countries. I think if there is interest among the Maghreb countries of North Africa, as part of their economic community, to undertake this type of activity then FAO would be happy to be part of that process. It is to the advantage of the countries to have that free movement of seed.

JOHN KEDERA (KEPHIS): In listening to the comments that have been made so far on the question, one of the things I see as a challenge is how we can move this discussion we are having here to the national level. That is where action is required. So it might be appropriate to look at systems that will allow us, at the international level, to move these issues to the national level so that we can access that seed implementation.

BERNARD LE BUANEC: That was almost exactly what I was going to say. The objective of the Conference here, and we will discuss this at the conclusion, was to identify the main issues or the main decisions that have to be made for improving and facilitating the development of new varieties and the delivery of good quality seed to farmers. But we can only discuss the general environment and pinpoint the main issues here. The specific topics will have to be discussed at regional and national levels as, obviously, the objective of this Conference is not to take a decision on a very specific issue. The objective is to raise awareness and then to give some arguments (with the bullet points we have agreed upon) to governments to get things moving.

ADELAIDA HARRIES (IOWA STATE UNIVERSITY): It is more or less related to the last intervention because the panel also said that it is necessary in developing countries to solve the problem of the movement of seed. First establishing a national seed policy with all the stakeholders together, but it is very nice for countries to have a White Paper with a national policy. The problem is the implementation. For me, the role of the private sector is very important, working together with the government. The capacity of the public sector, the seed associations at national or regional levels, for the advocacy or the lobby depending on the country to work on that and to have clear rules implemented to facilitate seed production and to facilitate farmers' access to improved seed. My question to the panel is my concern that it is not only the seed policy document, it is the implementation of the system.

THOMAS OSBORN (FAO): The seed policy is a process and the development of the policy, as you said, is the first step. I totally agree that it is not about having a nice report to put on the shelf but to provide the framework for better cooperation and collaboration of the activities in the seed industry. Seed “policy” is probably not the word I would like to use, it is more that everybody has a common shared vision of the seed industry in the country, and must be able to pursue that in an appropriate way. Of course, this is something that requires effort and can require funding, but certainly the commitment of the different partners and the role of the private sector and of the farmers is essential.

FRANCIS OBONGO NYACHAE (SEED TRADE ASSOCIATION OF KENYA): I wanted to follow-up on the areas where I think the panel can intervene. As I mentioned earlier, harmonization of seed policies and the regulations in Africa has been going on for quite some time. Governments in Africa, as you are aware, are heavily involved in seed regulation and so forth. In some countries, it is the public sector which is actually responsible for seed supply. Therefore, following this harmonization which has taken place, several countries have responded. In some, they even have legislation now that supports the development of seeds. Somebody mentioned SADC and that the meeting running now is expected to endorse some of the agreements. In COMESSA the same thing is happening. COMESSA has taken up some of the programs in Eastern Africa and they have intervened by saying that, yes, they will support this harmonization. What I am asking is where interventions can come, especially from international organizations such as FAO, OECD, ISTA and UPOV and to ask you members to conclude or to pass these regulations, so that they can remove the bottlenecks that have been hampering trade. I know that these regulations remove those bottlenecks, but then without the law being in place, if it's a Bill or a policy for 10 years, that does not help the private sector. So my first prayer to you is: can you do something about your own members? Tell your members, those who have not yet concluded the legislative or regulatory frameworks, or even institutional frameworks, to do that. The second issue is that of the private sector. I can again quote from Sub-Saharan Africa, with which I am more conversant, that efforts are being made for the private sector to participate fully in the improvement of seeds. The truth is that without the private sector, we can talk here for years and years and very little will be done. My request, especially, to those organizations such as FAO, who have done a lot in countries like Africa to develop the seed systems, is that I really wish that they would work more closely with the national or the regional seed associations to be able to propel the program forward. I know that FAO works with governments and governments, if they are the ones in charge of seed, will not be involved in the private sector. Can we advance this? If you can work with the private sector through governments, then maybe we shall be able to move rather than talk.

XAVIER BEULIN (CHAIR OF IFAP GROUP ON GRAINS AND OILSEED): I would like to use this opportunity after these three questions, to tell you about what's happening in France. For a number of years, farmers and producers have not only understood the purpose of action in the field of seeds, but they have invested in seeds through cooperatives and private associations and this has made it possible to consolidate the sector to make sure that there is a close responsibility between producers, the farmer, and the seed producer and other links and this has given rise to associations which bring people together around a question of seeds and these people now are interlocutors with the authorities and can discuss standards, harmonization and their varieties and also lobby and make representations between the professions and branches and arbitrate on different opinions. We haven't succeeded everywhere; we are part of Western Europe and we have arguments on biotechnology which are very difficult, but with regard to fundamental tasks of seed production, it shows that there is interaction between the interests of the producers and all those working in the area. When I say interest, people have been saying for a couple of days and this morning in particular, everyone recognized the importance of not just investing. We need human resources too in this very vital area of seeds. It is said that productivity gains will come 50 per cent from genetic improvements and it's clear that if we are able in seed production and among users - the farmers - if we can bring our interests together, then it would be possible to deal with investments better, but also to make sure there is a fair relationship with other authorities in other countries, because that is a very important question too.

ORLANDO DE PONTI (PRESIDENT ISF): I would like to strongly support the remarks made by Raouf and Obongo, I say this as a representative of the private seed sector because we have mentioned a few times that it is extremely important to have an enabling business environment. I think it is very wise that it has been mentioned once more and I would like those people who are in charge, and we all know the important role of FAO, to support those countries and regions so that from the very be-

ginning they bring representatives from the private sector on board in order to make sure, not only that the legislative and regulatory documents are in place, but also that implementation will be done in an effective and efficient manner and I am sure that, especially for the last point, the representatives from the national seed associations, from the companies, can really contribute to support the development of an efficient system.

THOMAS OSBORN (FAO): I think many of the issues with harmonization are the same issues we have with seed policy implementation at the national level. It's not just a matter of harmonization as the speaker has pointed out, but implementation. What we found is that many of the countries say that now we have harmonized standards, we need help in order to come up to the technical level to be able to implement those standards. I assume that is one of the topics that Joe was talking about in terms of work that they were following up in SADC. Certainly in terms of ECOWAS and the recent signature by the ministers of the harmonized standard for the ECOWAS region, we now have the same issue: we need to help them with implementation and to find donors that are interested. Donors haven't been so interested in capacity building, in implementing standards, but we will continue to pursue that. I think it is a good point; we do need to bring this to the attention of the ministers of agriculture and we will do that in the forum here at FAO.

ROLF JÖRDENS (UPOV): A brief remark from the standpoint of UPOV. There was a wish to encourage members of organizations to implement the systems. With UPOV it is the other way around. A country can only become a member of UPOV if it has the UPOV system in place, if the UPOV system or national legislation based on the UPOV Convention is operational in that country. That is perhaps important to note here. However, with regard to new members, we, as an intergovernmental organization, cannot take the initiative. The initiative must come from the governments of potential new members and in order for that to happen, it is extremely important that the breeders in that country, together with other interested parties, engage in a debate with the government and make clear that an enabling environment is essential if new varieties are expected to be made available to the farmers and growers. A joint effort is required; the profession must really explain the matter and, of course, events such as this one, which was right from the beginning aimed at encouraging governments to reflect on these matters, must come together. A joint effort is required. The initiative is important from those directly concerned; they must be very clear and very strong.

WAYNE JONES (OECD): At the risk of repetition, when the OECD hears people, particularly from industry, talking about the need to maintain open markets and facilitate trade, it is something that we very much support. That's the whole reason behind the OECD Seed Scheme – to help facilitate trade. Certainly, when countries apply for membership in that Scheme, the members have to go to the country and look at the processes in place and try to provide some advice on developing capacity so they can participate in the seed trade. It seems such a no-brainer that the benefits both from the export and the import of hybrid seeds are hard to justify not moving on quickly. That is why, in the strategy for the Seed Schemes, one of the key proposals is to become more engaged in the policy debate, because these are the issues that are quite important. You are absolutely right, it's the implementation that's important and that is why there is a need to spend more of your time on the policy engagement rather than just the technical side. One comment about aid: a lot of the funds that go into developing underdeveloped countries come from international aid and in the past that aid has gone to "sexy" projects. It's nice to produce fertilizer, build roads, but quite often there was a crying need for the institutions and the infrastructure. Now, at least under the Paris Declaration, member countries themselves are supposed to be calling the shots of what they need and listing their own priorities. I think there is a chance there to make sure that the aid institutions, the international organizations, play by the rules of the Paris Declaration and begin more and more to listen to the priority of needs in countries like Tunisia.

MICHAEL MUSCHICK (ISTA): I want to say something on the comments of Adelaida Harries and also of Mr. Obongo. I am fully behind Ms. Harries saying that implementation is a topic here and with implementation there are also the training aspects. I can only repeat what I said this morning: training is an important issue and we all need support from national governments and from the private sector in these regions as well as from capacity building organizations, to be in the position to provide the necessary training. That is a key issue and we see that at the ISTA level very clearly. We try to help where we can, but we also need some support.

MARCEL KANUNGWE (AFRICAN SEED TRADE ASSOCIATION (AFSTA)): I just wish to extend the great appreciation that made it possible for me to attend this Conference. I am President of the African Seed Trade Association. We have already discussed at great length the issues of private/public partnership. I want to re-emphasize that representing the seed industry in Africa, I have noticed some areas, some of which we have discussed here. We have our governments which we need to push on a lot of issues, then we have the emerging private sector, particularly in Eastern and Southern Africa, and then we have got quite a number of international and local agencies. My appeal is that finances are limited and we have talked about cooperation. A lot of emphasis has been put on the informal sector. I just want to assure the delegates here and particularly the key persons who are involved in the policy issues, that as far as the seed industry is concerned, we regard the informal sector as our reservoir for future business. So we are very interested to see that there is progress in the informal sector because it forms the backbone of our future business. In our request to engage with both the public and the international organizations, we just want to see how we can rationalize the limited resources that are available and I hope that by meeting the people concerned at this Conference will enable us later on to make the necessary approaches so that we make rational use of the limited resources.

ZEWDIE BISHAW (ICARDA): I think some questions are being asked already regarding the policy element and my question is where the government is willing; we have policies, regulations, which are in place. As I have said, implementation to me is much more than that. Implementation comes from the commitment of the government. It is not a question; it is more of a comment: how we, as a group, not only those who are sitting on the podium, the national programs themselves will come together and be able to influence the policy-makers. Because one commitment, for example, is that countries have to put 10 per cent of their GDP into agriculture. What would be a strategy to really make sure that even that investment could be made?

BERNARD LE BUANEC: This is, as we have said, a national problem and the objective would be that you take the conclusions of this Conference and go to your government or to the various governments to say that these were the findings of this international Conference, now can we sit around a table to see how to implement them?

JOSEPH CORTES (SEED SCIENCE): Mine is more of a request. As one of the guilty parties, together with FAO and other organizations, attempting to harmonize policies and regulations that will favor private sector expansion, I have to agree with many of the previous speakers who have mentioned that implementation is perhaps one of the areas where we see less and less effort and funding being placed. There seems to be this conception that after signature by the ministers of agriculture everything is perfect and we don't have to worry about anything else. On the contrary, that's just the beginning. The FAO representative mentioned it, Obongo mentioned it, there are many who have mentioned that this is an effort that is going to take at least another three to five years until everybody is up to the same technical level. Now, as people who are involved in trying to implement this, it is extremely difficult to find funding to bring 15 SADC countries up to the same level of funding for bringing six countries of Central America up to the same level, or 17 countries from West Africa up to the same level; those funds are simply not there. So what is my request? I think that all of us have access to donors in one way or another; we have access to donors in every one of the countries that we are talking about. If all of us, collectively, every time that a donor says he wants to do something in seed, the very first thing you say is that we need to implement this and part of the funding goes to making sure that that piece that is missing is, in fact, conducted. It doesn't matter that it is conducted by donor A, B, C, D; that's secondary. So that is my request to all of us when we talk to donors; let's tell them about the importance of implementing the regional harmonization frameworks. Otherwise it will take 20 years.

JOHN KEDERA (KEPHIS): I agree with what you are saying but at our own level we also have to put some things in place. Recently, I read an article that said "Bill Gates has 24 hours", it also means we have 24 hours. What do we ourselves do at the national level? It is not going to be something coming from outside, it has to be accepted at the national level. This is what we must do. So that whatever the donors come up with is what you are going to implement and that is where the challenge starts.

BERT VISSER (CENTRE FOR GENETIC RESOURCES, WAGENINGEN UNIVERSITY AND RESEARCH CENTRE (NETHERLANDS)): It might sound like an open door, but I always seem to sense that it is necessary to stress it, and it is that whether you talk to national governments about implementation, already you talk with

donors to see what they can contribute; whether national donors or the Gates Foundation. It is important to link with the perspective of the donors and national governments, not necessarily your own. It is also important in my own experience to look at any activities that you propose from a perspective of what they contribute to food security at the global level; what they might contribute to sustainable development. What they can contribute to rural development. Don't start with a quest for harmonization but place it in a larger framework. That is very important in any discussion to get an interconnection between governments and donors.

ANDY LAVIGNE (AMERICAN SEED TRADE ASSOCIATION (ASTA)): I look at what we have heard over the last two days as great opportunities for going forward with some challenges that the seed industry has to address, given the evolution of the industry that the innovations, new technologies that are there to address a lot of the issues. The plant breeders of this industry have, as we have heard, risen to the occasion to increase yields and have the opportunity to continue to increase yields down the road. The bigger issues of the developed countries that we have, or challenges that we have in the plant breeder community, will I believe be solved. But if we don't come out of these three days with some ideas other than five areas with 10 topics that we all agree on and no goal of some kind of things to come back with in 10 years, I bet that the list in 10 years at the Third Seed Congress will look the same. We'll still have dying plant breeders, we'll still lack laboratories; we'll still have challenges with our phytosanitary rules; we'll still have challenges for training. My challenge to us, and especially to the organizers, was how do we think outside of our box. It seems like what we do is we go and we sit down with a country and say: "You need to become a member of, in this case ISTA, and you need to set up your labs and you need to train. You need to adopt IPPC standards, go ahead so that we can move seed in and out of your country." The capacity just to start the process in each of those areas for governments is not there, let alone the capacity to have lab staff, to have plant breeding programs to set up a germplasm system. Can we pick 10 countries so that in 10 years when we come back we have examples for the rest of the world of where we can develop bases and other programs? That, to me, is an option. If we talk about the problems we have today, we won't make the leap to find the solutions for tomorrow. Our organizations, whether they be public or private, have that opportunity to make the changes. Many of our countries, our companies, are doing business in these countries and I would challenge the panel and the governmental organizations as well as the ISF, the regional seed associations and the national seed associations, to come together to figure out ways where we can find different solutions in these countries and establish examples for growing the seed industry and improving the lot of the worlds' farmers in the future.

WAYNE JONES (OECD): I am not sure it is a reaction to the proposal, but I think I am quite sympathetic to it. Quite often at the international level when we see the statements coming out of meetings on food security, on agricultural development, they are very bland. They are statements like: we need to use 10 per cent of the national budget on agriculture; we need to increase the proportion of aid to agriculture back to where it was at 17 per cent. These are just numbers and they don't help much in the policy debate. As I said in my first intervention, really what groups like this need to do is to provide the details, to tell the politicians what to do with that money: What to do and how to do it. That implementation advice is what is really missing and that is where the linkage between the international policy debate and organizations like this needs to come. There is a good reason why national governments and international aid agencies withdrew from agriculture: a lot of the money put into agriculture was deemed not to be very successful: low returns or no returns at all. Similarly, there were other opportunities such as education or health that they could put their money in and which they thought gave higher returns. That's a logical, rational decision on the part of policy-makers and normally, if you understand what's at stake, you'll find their decisions are relevant. One of the messages we need to get across and IFAD is quite good at that, is showing that times have changed and both the need for and the return to investment in agriculture are looking much more positive than in the past. I think this is what we need to work on. In the OECD we are trying to learn more about agricultural development. We are trying to develop a much stronger argument for investing in agriculture as a major way for economic growth, particularly in developing countries. There is an argument for it but it's hard to prove. We are trying to develop an analysis that can do that. We understand that the kind of development strategy is different for virtually every country on that path to development. There is no one-size-fits-all, certainly not the policy experience from OECD countries for some of the least developed countries. We are trying to understand the priority of things that need to take place in that regime. I would still like to come back to my first point, which is all your good inten-

tions will fall on stony ground unless a lot of the other barriers and intransigencies are removed at the same time. There are all kinds of policy distortions out there that restrict trade: the tax on agriculture in some countries; the failure of input markets; the failure to have significant returns or any kind of risk management for small producers in developing countries that would encourage them or allow them to take the chance to use the kind of technology you are talking about. All of these things have to be in place for strategies on increased research and research transmission extension to work.

ORLANDO DE PONTI (PRESIDENT, ISF): I think that Andy raised a very good point in trying to convince the organizers of this Conference to become more concrete about the action to be taken and to do that in collaboration with those people who are familiar with the issues, like national associations, regional associations, etc. But I would like to mention to all of you that about a year ago, before we were all occupied by the financial and economic crises, we were talking about the food crisis and in this house, there was a high-level meeting organized by FAO, and then later on in August at the United Nations headquarters at their invitation, and they already decided a year ago on a strong plan of action for improving seed systems around the world, especially for those countries where there is a still a great need. The ISF was represented through its Secretary-General and we stated very clearly that industry, the private sector, is very willing to participate and to offer support in whatever way that is related to their competence. Industry is not going to take the lead; this is an issue that should be taken care of by governments and we pinpointed very clearly that, as far as we are concerned, FAO should take the lead and any time they call on us, the ISF would be willing to reply and to call on their members to do whatever they can. Maybe it is a good moment to ask FAO where they are since those two important meetings a year ago.

THOMAS OSBORN (FAO): I agree that we need to think outside of the box. I think calling this meeting and having it as a collaborative meeting among many of the institutions and the private sector involved in the seed industry is an important step. We need to coordinate and work together more effectively. In terms of the promises that were given to FAO by the donors, there were big numbers, but a lot of the numbers seem to be a bit empty, although when we received money, some of the activities went into seed systems. The work we are doing in Afghanistan, a project going on in Burkina Faso, Mozambique: these are three of the bigger projects we are implementing with European Union funding. But there is more work to be done. We are working with the African Union on the African Seed and Biotechnology Program as a framework with the member countries, with our partners. This has been slow in setting up, but I think we're moving that forward as well. I think we are trying to do our part and we are trying to secure funding, but just like all other efforts, you need funding and support in order to make these things happen in the field. I think there is a lot of potential and we will continue to try to work together to see how we can push things forward. When you intervene in the seed system or in agriculture, it is complex. If you just have the IPR issue solved, or you just have the seed testing solved, that's not enough. There needs to be intervention and success in a number of areas in order to make things work. In the context of this meeting, what we are trying to do is to move forward in a more coordinated way.

BERNARD LE BUANEC: Obviously the suggestion made by Andy Lavigne is interesting and I would encourage the five organizations to call a meeting soon to see what they can do. The difficulty will of course be to agree on the pilot countries. I can tell you that tomorrow morning there will be a meeting in this building to see if it is possible to set up a specific project in some pilot countries. The message has been heard and I will really encourage the five organizations to go further on that – it is a good suggestion – and we already had that in mind.

HOSEA SITIENEI (KENYA SEED COMPANY LTD, KENYA): I think we have all agreed that we have a crisis, the crisis of hunger globally, and particularly in the Third World. This is despite the fact that we have better varieties today, better seed than in the past. What I have observed is that one of the problems is that seed, even where systems exist and work, is not affordable. Seed is quite expensive for the rural farmer. Some governments have gone into the question of subsidizing the seed and other inputs. I do not know whether FAO and other donors are encouraging this kind of intervention so that the farmers can get seed, because I don't believe you are going to talk about breeding new varieties to solve today's problems. I think we have the seed that we have today and that seed is able to solve some of the problems, but it is not affordable to the majority of farmers. Do you encourage subsidies the way some governments are trying to?

THOMAS OSBORN (FAO): Do we encourage subsidies? I would say no. But on the other hand, for emergency situations or vulnerable households who have lost their means of livelihood, drought, floods, civil conflict, we provide seeds and sometimes fertilizer and other inputs to help them recover from an emergency crisis. So I don't necessarily consider that as a subsidy, but those are the conditions under which we would provide seed on a free basis.

BERNARD LE BUANEC: I know that the question of subsidies is a question that has been discussed quite extensively for many years and that it has been considered that giving subsidies to buy seed depends on how it is done. It can be detrimental to the emerging private sector if it is not done properly. It can be extremely useful if it is done properly like, for instance, a seed voucher. But if subsidies for seed mean just giving seed from somewhere to the farmers, it is a catastrophe for the emerging private sector, so we have to be extremely careful.

GARLICH VON ESSEN (EUROPEAN SEED ASSOCIATION (ESA)): I would like to come back to the title of this panel discussion: "providing an enabling environment". I think that is exactly why you are sitting up there. Industry and the member states have chosen their enabling environment: your organizations for the representation of industry, for quality assurance, for facilitating international trade, for assuring seed health, so I think what has come out of the three days is very clearly that we know how to do it. There is a clear choice among countries as well as industry about what kind of environment we need and that, indeed, ensures progress. Now, obviously there are obstacles. There may be a lot of things that can still be improved. I think the stronger involvement of the private sector is one of those and that definitely depends on the development stage of the country. I think where we also need to look in detail is where we see contrary movements, basically a disabling environment if you like. That doesn't usually come from your organizations; it comes from other organizations and perhaps one of the demands or requests that could come out of this Conference is that those organizations that provide the enabling environment also have to speak up more loudly and more clearly to those that make things difficult for the seed industry and for the seed sector in general. That is when you place too many burdens on one single input factor. Just with seed, we are not going to change the world, it is only a part of that. So if you try to have environmental goals, public health, development goals, all placed on this one tiny sector (Bernard has pointed out how tiny it is) I think we are trying to do a bit too much. But if we could ensure that these organizations, with their credibility with governments argue their case and make sure that we don't get disabling legislation as in many parts of the world, and we can talk about Europe there if need be, then I think we would already make progress. Going out and lobbying for this is not only the job of industry, it is the job of these organizations and that is why they have been set up, to encourage you to speak out in favor of this important sector, not only to us because we know, but to your colleagues who disagree.

BERNARD LE BUANEC: What you are raising is a problem of coordination among governments within one country and obviously, if each of those organizations here could have a role at their national level to try and get that harmonization at the government level, that would be very interesting, but it is difficult.

ROLF JÖRDENS (UPOV): The organizations are of course the members. It is not the secretariats which govern and shape the course of the organizations, it is the members. But what we as offices, secretariats, of those organizations can do and what we try to do is to inform our members, in the case of UPOV, about what is going on in other fora. Then it is the role and the responsibility of the individual members to try to coordinate action at a national level. That is all that, we at least, as a secretariat, can do within such an organization.

ISMAHANE ELOUAFI (CANADIAN FOOD INSPECTION AGENCY): My question to the panel is in relation to the public plant breeding sector, its importance and maybe its transformation in the new era, so I am wondering if we are witnessing right now the disappearance of public plant breeding programs in national and international institutions and I can say that in Canada, we have a decrease of funding in plant breeding and also a shift of priorities away from plant breeding. I think I can see the same thing in the CG Centers. So I would like the panel's view on this and how they foresee the future for public plant breeding.

ORLANDO DE PONTI (PRESIDENT, ISF): I can give a short reply on this. I would say this is evolution; this is a very natural process. If you go back 200 years, there was only public plant breeding. Step-by-step, depending on the degree of development, private people, private industries have appeared and they started to develop commercial varieties. Of course, in the beginning this was sometimes in competition with public varieties, but then in many countries the government said: "We have an effective private sector, so let's do other things". So it moves up from commercial breeding in the public sector, to what we call "pre-breeding": the basic understanding of genetics, new traits, which is then passed on to the private sector in order to produce the very best varieties and this has happened in the Northern countries and it will happen in the Southern countries: it's simply a matter of when and how and where.

ROLF JÖRDENS (UPOV): Another remark from the standpoint of UPOV. The systems of IP protection, including the UPOV system, encourage breeding in those areas where there is a commercial market. The UPOV system cannot, of course, encourage breeding in sectors and for crops for which there is no existing or potential market. It is nevertheless very important to integrate this effect into a national breeding policy. The public sector can then concentrate on those crops which are not taken up by the private sector because there is no commercial market. There is the possibility to reshape priorities in public sector breeding and to do more with the same or perhaps with less money, because you have here shared responsibility and complementary action of the private and public sectors. That is perhaps one of the answers that can also be given in this respect.

BERNARD LE BUANEC: I think we have to think more in terms of complementarity than in terms of competition.

VICTORIA HENSON-APOLLONIO (CGIAR CAS-IP): I head up the Central Advisory Service on Intellectual Property. Because we are fortunate to have this meeting in Rome, I have our entire CAS-IP team, so we have six people attending this meeting. You might ask yourself why. I am curious to get a response from the panel in terms of what they see as the role of people who are in IP practice and technology transfer practice on the ground. We work very hard to occupy that layer where we try to work with what implementation there has been, and to see how far we can push it. We are having a team meeting over the two days; we have come from all over the world, to get together to see what we have learned from this meeting. I am curious to know what your recommendations would be in terms of the role of IP professionals and people who work in trying to draft agreements and documents that help public/private partnerships and to understand what we can do on the farmer's side with quality seed to make farmers aware of quality seed and what it means to them in terms of their scarce resources. What do you see as our role?

DOUG WATERHOUSE (AUSTRALIA): I certainly can't answer in the broad sense, but I can pick up on one of the issues that may interest you, because you have many roles; you are dealing with donating and receiving and a lot of different things. There are two issues: the first is to do with your opportunity to help educate people about the responsibilities, obligations and advantages that come with intellectual property. One of the things that we see is that there is not often a very good understanding of the obligations in relation to a particular piece of intellectual property. Take the UPOV system, for instance, here it is very clear what the exclusive rights relate to, what the scope of protection is and how it is extinguished. But, in general, many receivers of material don't understand that very well at all. I think we all have an obligation to try to explain what the obligations are that are attached to the material that you receive. The second issue, and I would like to pick up on our colleagues from Iowa, where they highlighted the fact that if institutions don't have a credible and coherent IP policy, then it is very hard for them even to start to deal with these sorts of questions. So there is also some responsibility to help receivers understand this policy, and sometimes they are reluctant even to engage the thought of having an IP policy, because they really don't understand what that might mean for them. There is an opportunity for your team of six, which probably outnumbers some of the secretariats here, to spread the word and to encourage people to develop their institutional IP policies so that they can start to deal with materials to which intellectual property attaches everyday and it is not a threat to them, but actually an opportunity to facilitate whatever they want to do with this material. On those two points, I think that you have got quite a large job. But let me turn this back to the panel who may have other ideas about how IP professionals such as you may engage in this area.

ORLANDO DE PONTI (PRESIDENT, ISF): I agree that it is a very important question and I would like to re-read one of the conclusions of the first session. “Intellectual property is crucial for sustainable contribution of plant breeding and seed supply”. Intellectual property protection is crucial, but it is a profession. I still remember the days when every plant breeder had some clue about UPOV. There were no lawyers in the companies and they were well able to do the business and were filing their varieties for PVP protection. I also remember the days when working in the private sector, I had to draw up a contract with the public sector – half a page was enough and everybody was happy and there was no problem. I haven’t seen those types of agreements for the last 10 years, now it’s rather 20 to 200 pages! There is a lot of legal wording in it and I would say, also from the industry, whether we like it or not, the reality is that there is a lot of exchange of IP assets and that is a good idea. There is an exchange in order to help each other to do a better job in making better seeds. But exchange is no longer by a handshake; it is by an agreement. I am very pleased to notice, and I learned a couple of years ago, that the CGIAR has also understood that there is a need for this type of professional, especially because you can see on all websites that the CG Centers are more and more engaged in public/private collaboration. “Collaboration” is a nice word, but it is an agreement, and I really wish you a lot of good luck in your good work, because you are six and if you count all the lawyers in the private sector, I think you get thousands! So it is very fair and very wise that the CG takes this role very seriously.

FRANÇOIS BURGAUD (GNIS): I just wanted to add that the African Seed Association (AFSTA) and the Asia and Pacific Seed Association (APSA) some years ago took a position in favor of plant variety protection. I would invite all those of you who do not know these organizations to go to their websites, to see that the breeding companies of which they are composed are not multinationals, but African and Asian breeders and sometimes very small seed producers. Second, I would invite the national and regional organizations to be more proactive at the national level. I recall that maybe governments have all talked on the need for public/private partnerships to be able to respond to the food crisis of several years ago, but today the private sector is not represented at the Food Security Council at the international level; we had to struggle for it to be accepted and it should be in the next reform, and I invite seed organizations to request observer status, because otherwise they will not be invited. I would like to break the consensus; we are all in agreement that we need a link between the farmer and the seed companies, however, Xavier Buelin reminded you, perhaps in too light a manner, that there are two ways of making this link. As we heard yesterday, African seed producers don’t think that the African farmer is condemned to use only the seed in his traditional community, that he has the right to access quality seeds and genetic progress. For that, we need to redistribute aid and I repeat what I said this morning, the great majority of aid given to the seed sector today does not reach the people producing or selling seed in developing countries. For example, Thomas Osborn (FAO) mentioned the project in Burkina Faso financed by the European Union: 19 million euros over 2.5 years. None of the seed producers in Burkina Faso have been contacted. They are not mentioned anywhere in the project, which I have here. Public research is mentioned, all of the NGOs which “compete” in the world of food security are mentioned, but the private seed sector is not mentioned. As long as we continue making projects such as that, we will not help the development of the seed sector. This message must be clear, to the farmers of those countries and to donors.

BERNARD LE BUANEC: It is true that there is still a lot of progress to be made in the area of synergy between the public and private sectors. There will be an item in the conclusions.

ANKE VAN DEN HURK (PLANTUM NL): In the discussions we have had this afternoon we were talking on a lot of issues we dealt with during the last two days. We didn’t talk a lot about access and benefit-sharing and access to genetic resources and sharing them. It is a pity that Mr. Bert Visser, the Director of the Centre for Genetic Resources at Wageningen University and Research Centre has left, but I would still like to put this question to the panel. Mr. Visser indicated yesterday that access and benefit-sharing were accepted differently in developing and developed countries. He said that in the developed world, we are looking at access and that in the developing world they are looking at benefit-sharing. When we heard the discussions we recognized, in fact, that for the seed sector, especially in developing countries, it is in principle the opposite. They are probably much more dependent on access because they don’t yet have collections. I would like to ask the panel how they think we can get this message across to those people who are negotiating the international treaty, who are negotiating on access and benefit-sharing, to demonstrate to developing countries that they

also need access and that it is very important for their seed systems and indeed to show this to the developed world.

ORLANDO DE PONTI (PRESIDENT, ISF): I would agree that access is, I would think, one of the key notions in effective plant breeding. That is also the reason why the breeder's exemption under UPOV is so important. On the one hand you have protection of your variety, so nobody is allowed to copy it and to sell it and compete with you, because then you get price competition, etc., but everybody is free to use it as starting material for another variety. I think it is a very important notion and that is the reason it has been re-emphasized, especially for those countries that are still in an early phase of plant breeding. If I had to do a breeding job in Zambia or in Sierra Leone, the first thing I would do, as a breeder, is to collect everything I could get from the wild, from the local varieties, from varieties from the same climate zone, from universities; the most varieties possible. I'd then plant them in the field, see what they were and then make my selections and my crosses. This is the fastest way to get to a variety that clicks in a particular country. Right access is extremely valid also for developing countries. If you turned that benefit into having free access for further breeding, if you translated that into real money, you would end up with an extremely high figure. It is an important contribution in kind and represents an enormously large figure.

BERNARD LE BUANEC: I think, Anke, that your comment is also linked to what François Burgaud was saying before. In discussions at international level on those aspects, industry is never invited, only the NGOs. You will remember how difficult it was for me to be able to take the floor in the discussions on the international treaty: it was said: "You are from industry, you should go to the balcony and you are not allowed to speak". So the ISF left the meeting. We are talking of good synergy – it is not yet there, but maybe the meeting of today will help to get there.

XAVIER BEULIN (IFAP): Just a reaction to your question, Anke. I would like to thank you for your invitation. I basically agree with what has been said in many international bodies. Farmers such as me are not always invited. A number of farmers' organizations are invited, not necessarily the one I represent. What is of interest to me is if a farmer that I represent sends an order for seeds, then I would ask that you produce more and better and good quality. But I come from a country where society expects something else. They expect answers about climate change, about biodiversity, about the environment, so it is a combination; it is not always easy to bring the conditions together. I would say it is important that there be convergence of opinion for the end users and those who will be using genetic potential and I don't think in developing countries either that we can do without combining legitimate attempts in the productive part of the economy, together with expectations that are not economic, but where we need to find a balance.

ORLANDO DE PONTI (PRESIDENT, ISF): I would like to mention one more time that the target of the private sector is to develop and produce the best genetics in the best seeds. I would like to highlight one important point. After development, it is a long road before we have the very best in a bag of seeds. I would like to re-emphasize the importance of seed processing, seed enhancement, and - this word hasn't been mentioned - quality control. Because you buy seed from a company and before the seed goes to the farmer, the company has to be sure that it meets the standards set by ISTA and the company. I would like to close my remarks by coming back to your question about assurance and insurance. Well, it's not an insurance, but when you buy seed from a company under proper conditions and it says that what you buy should be up to standard, if it is not, and it can be proven that it is due to faulty seed, and I know it happens, we get a claim and we have to pay.

JOHN KEDERA (KEPHIS): Just to say that those of us in the public sector are committed to using the international best practices that are available in an effort to remove barriers to trade. If those in the private sector find issues, we would like to you to continually raise them so that we can work together in the best interests of the seed business.



CONCLUSIONS OF THE SECOND WORLD SEED CONFERENCE

BERNARD LE BUANEC*

The Second World Seed Conference (Conference) recalled that agriculture needs to provide sustainable food security and economic development in the context of current and future global challenges. This Conference has highlighted the critical role of new plant varieties and high quality seed in providing a dynamic and sustainable agriculture that can meet those challenges. It is concluded that governments need to develop and maintain an enabling environment to encourage plant breeding and the production and distribution of high quality seed. The Second World Seed Conference identified the following elements in providing such an enabling environment:

- ▶ Plant Breeding has significantly contributed and will continue to be a major contributor to increased food security whilst reducing input costs, greenhouse gas emissions and deforestation. With that, Plant Breeding significantly mitigates the effects of population growth, climate change and other social and physical challenges.
- ▶ The International Treaty on PGRFA is an innovative instrument that aims at providing food security through conservation, as well as facilitated access to PGRFA under its multilateral system (MLS) of access and benefit-sharing. The MLS represents a reservoir of genetic traits, and therefore constitutes a central element for the achievement of global food security.
- ▶ Intellectual property protection is crucial for a sustainable contribution of plant breeding and seed supply. An effective system of plant variety protection is a key enabler for investment in breeding and the development of new varieties of plants. A country's membership of UPOV is an important global signal for breeders to have the confidence to introduce their new varieties in that country.
- ▶ Seed quality determination based on scientific principles before supplying the seed to farmers is an important measure for achieving a successful agricultural production. The establishment or maintenance of an appropriate infrastructure on the scientific as well as technical level in developed and developing countries is highly recommended.

The development of reliable and internationally acceptable certificates, through close collaboration between all stakeholders along the supply chain for varietal certification, phytosanitary measures and laboratory testing contributes substantially to the strong growth in international trade and development of seed markets.

Overall Conclusions

- ▶ Participation in internationally harmonized systems (ITPGRFA, OECD, UPOV and ISTA) is an important means for countries to increase the availability of germplasm, new plant varieties and high quality seed for the benefit of their farmers, without which their ability to respond to the challenges ahead will be substantially impaired.
- ▶ A predictable, reliable, user friendly and affordable regulatory environment is crucial to ensure that farmers, have access to high quality seed at a fair price. Cooperation between international governmental and non-governmental organizations, on the basis of mutual supportiveness, is essential in order to provide effective assistance to governments in the development of an enabling environment.
- ▶ The conference acknowledges the important role of the public and the private sector to meet the challenges ahead. It also recognizes the benefits in developing complementarity and synergy between the public and private sectors.

Urgent government measures and increased public and private investment in the seed sector are required for the long term, if agriculture is to meet the challenge of food security in the context of population growth and climate change.

* Chairman of the Organizing Committee

BIOGRAPHIES

USHA BARWALE ZEHR

Ms Barwale Zehr graduated with a BSc. in 1981 from Wilson College at the University of Bombay, India. After that she was awarded an MS and, in 1985, a PhD in Agronomy at the University of Illinois, US. Since 1991 she has been the Director of the Barwale Foundation and has worked as a geneticist in sorghum and millet at Purdue University, Indiana, US. From 1997 until 2006 she was a trustee of the M. S. Swaminathan Research Foundation in Chennai, India. She has occupied and is still occupying many positions, most notably as a board member of the Donald Danforth Plant Science Center and of IRRI and CIMMYT. Since 2000 she has been the full-time Director of Maharashtra Hybrid Seeds Co. Ltd., Jalna, India. With advances in plant biotechnology in recent years, her research interests have been in applying these tools to improve agricultural productivity. With the use of genetically enhanced crops and genomics, many opportunities have been presented for improving productivity in a sustainable manner. Use of molecular tools to enhance breeding activity, use of genomics to gain a better understanding of crops, deploying new tools to enhance the nutritional value of food grain are just a few of the possibilities. Her objective is to look at possible technologies and work to bring them to the farmers.

XAVIER BEULIN

Xavier Beulin was born on December 19, 1958 at Donnery, Loiret, France where he has farmed since 1976, cultivating 170 hectares of cereals and oilseed and protein plants. Since 2001 he has been the local President of the Conseil économique et social régional du Centre (CESR); since 1995 Economic and Social Council President of the Chambre départementale d'agriculture du Loiret; since 1990 Vice-President of the Fédération départementale des syndicats d'exploitants agricoles du Loiret (FDSEA); since 2005 first Vice-President of the Chambre régionale d'agriculture du Loiret; since 2005 national first Vice-President of FNSEA (the French national farmer's union); since 2007 President of the High Council of Cooperatives (HCCA); since 1998 President of FOP (the Federation of French Producers of oilseed and protein-rich crops). FOP represents 150.000 French producers of oilseed and protein plants.

Since 2000 he has been President of Sofiprotéol which is a financial corporation in the protein crop and oilseed sector. Since 1983, Sofiprotéol has upheld the development of oilseed products and protein-rich crops in France by providing appropriate financial and industrial resources. Since 2000 he has been President of Cetiom (the Technical Center for Oilseed Crops). Cetiom is a technical research and development organization serving French oilseed producers. It deals with the following main crops: rapeseed, sunflower, soybean and linseed. Since 2000 he has been President of the port of La Rochelle and since 2002 he has been President of the European Oilseed Alliance (EOA) which represents European oilseed and protein producers by defending their interests.

Xavier Beulin is chairman of the IFAP (International Federation of Agricultural Producers) Group on grains and oilseeds.

SHAKEEL BHATTI

Shakeel Bhatti was appointed Secretary of the Governing Body of the International Treaty on Plant Genetic Resources for Food and Agriculture (IT PGRFA) by the Director-General of FAO on January 29, 2007. Before joining FAO, Dr. Bhatti headed the Genetic Resources, Biotechnology and Associated Traditional Knowledge Section of WIPO. He was instrumental in the creation of the Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore (IGC) and served on the Secretariat of this Committee. Before establishing the IGC, he worked in the Development Cooperation (and Copyright Law) Division. Before joining WIPO, Dr Bhatti worked on his doctorate at Duke University, US on the scope of patentable subject matter under Article 27 of the TRIPS Agreement in relation to genetic resources and biotechnological inventions. He is currently completing a second PhD in bioethics, biotechnology patenting and the right to food.

MARCEL BRUINS

Marcel Bruins completed his studies in plant breeding and plant pathology at the University of Wageningen in the Netherlands in 1989. Based on the research he did on *Fusarium* resistance in wheat at Plant Research International, he was awarded a PhD in 1998. For many years he was responsible for the patent portfolio of a large public research institute and then worked in Rotterdam at the Innovation Center for Inventions where he was active in the commercial aspects of agricultural and biotechnology inventions. In 1998 he joined the breeding company Seminis Vegetable Seeds where he was Manager Plant Variety Protection WW but also worked on other aspects of intellectual property, such as patents and trademarks. During this period he served on several international committees in organizations like the European Seed Association, the Dutch Seed Association and the International Seed Federation (ISF). He has also chaired several of these committees. Marcel Bruins joined the ISF in 2007 as Secretary General.

MARCEL KANUNGWE

Marcel Kanungwe holds a diploma and a BSc. in agriculture from the University of Connecticut, US and the Haile Sellasie University in Ethiopia. He subsequently worked for 11 years in the management of livestock and cropping enterprises. Since then he has worked for 28 years in the management of different seed enterprises. After having served as General Manager of Pannar Seed for 11 years, he became Director in 2006. He was the President of the Zambia Seed Trade Association from 1999 to 2007 and is currently the President of the Africa Seed Trade Association (AFSTA), his two-year term ending in March 2010.

PETER BUTTON

Peter Button has been the Technical Director of UPOV since September 2000. Mr. Button holds a BSc. Honors degree in biological sciences. From 1981 to 1987 he worked for Twyford Seeds Ltd., a UK plant breeding company, in the development of new cereal varieties. Between 1987 and 1994 he was the General Manager of Twygen Ltd., a company which developed micro-propagation systems for the commercial production of seed potatoes and soft fruit stocks and continued as General Manager, following the change of ownership of GenTech Propagation Ltd. in 1994. In 1996, Peter Button joined the British Society of Plant Breeders as Technical Liaison Manager, where his responsibilities included the operation of officially licensed variety trials. In 1998, he became Technical Liaison Officer for the UK Ministry of Agriculture, Fisheries and Food (Plant Variety and Seeds Division), where he was responsible for the operation of the tests and trials associated with the UK Plant Breeders' Rights and National List schemes and Seed Certification in England and Wales and was the UK representative on the UPOV Technical Committee.

JOSEPH CORTES

Joseph Cortes was awarded a PhD in seed technology in 1987 from Mississippi State University, US. He completed his MSc. studies in 1979 in post-harvest technology at the University of Campinas, Brazil. In 1973, he studied agricultural engineering at the National University of Colombia. Since 1991 he has been Global Seed Program Leader at the Seed Science Center at Iowa State University and has held various positions such as Head of MIAC-Peru/Seed System Development at Iowa State University from 1988 to 1992; Assistant Professor/Research Associate, Seed Technology, Mississippi State University from 1984 to 1988; Training and Research Associate, Seed Unit, CIAT (International Center for Tropical Agriculture) from 1974 to 1975 and from 1979 to 1984 and, between 1975 and 1979, he headed the Food Department at Universidad Del Valle.

He has been involved in issues of harmonization of seed policies, regulations and development worldwide and has received many honors and awards including the following: an award from ASTA for Vision and Work in Seed Regulatory Systems Reform Resulting in an Improved Global Trade Environment in June 1999; an award from the Central American Organization for Regional Plant and Animal Health for Technical Assistance in the Harmonization of Seed Policies and Regulations in January 2000; an award from USAID/Peru for development of the national seed system in 1992; an award for excellence in seed science and technology from the Crop Science Society of America in 1991. He served as Executive Secretary of the Central American Regional Seed Committee in 1983 and as President of the Colombian Society of Agricultural Engineers in 1981.

ORLANDO DE PONTI

Orlando de Ponti is a graduate in plant breeding from the Wageningen Agricultural University, where he also received his PhD. After 20 years working as a scientist and research director in plant breeding and plant protection at the Wageningen Research Council, he joined the private sector. From 1991 until 2008 he was the Research Director of Nunhems BV, the vegetable breeding company of Bayer CropScience and from 2008 to 2010 he has held the Presidency of the ISF.

KATALIN ERTSEY

Ms. Katalin Ertsey is the ISTA President/Director at the Hungarian Central Agriculture Office with responsibility for variety registration including DUS and VCU tests, certification and marketing control of seed and propagating material and Honorary Professor at the Corvinus University Budapest. She graduated from the University of Horticultural Science Budapest and her thesis was on the subject of the Evaluation of Alternative Methods of Vegetable Seeds. After graduation she joined the National Seed Inspectorate (one of the predecessors of the Central Agriculture Office) and for the next 15 years she passed through the ranks to become leader of the Central Germination Laboratory, head of the Hungarian Seed Certification Scheme, and in addition, five years ago, she took over responsibility for national listing and variety registration. In 1995 she completed her PhD with a degree thesis on the Effect of Seed Vigor for the Value of Vegetables. During the transmission period leading to the adhesion of Hungary to the EU she worked on legal harmonization, extending her mandate in Brussels. She has wide-ranging experience in variety testing, seed production, processing, seed physiology, testing and seed legislation and comprehensive knowledge on bilateral and multilateral cooperation. In 2006, she became an EOQ (European Organization for Quality) Quality Manager and Auditor. She has been a member of the ISTA Executive Committee since the 23rd ISTA Congress in Buenos Aires in 1992. During the triennium 2007 to 2010 she is serving as President of ISTA and has been nominated as leading agricultural expert during the Hungarian presidency of the EU in 2011.

ELCIO GUIMARÃES

Elcio Perpétuo Guimarães received his BSc. degree in agronomy from the Escola Superior de Agricultura Luiz de Queiroz in Brazil and was awarded an MSc. on genetics and plant breeding from the same university. In 1976 he began working as a rice breeder at EMBRAPA. He obtained a PhD degree in 1985 from Iowa State University, also on genetics and plant breeding. From 1989 to 1996 he worked as a rice breeder at the International Center for Tropical Agriculture (CIAT) in Colombia. In 1996 he returned to EMBRAPA where he remained until the end of 2001 when he became a senior officer at FAO. In his career he has been responsible for releasing several rice varieties in Latin America and has published and edited several books and technical articles.

JOHN HAMPTON

John Hampton is Professor of Seed Technology at Lincoln University in New Zealand and Director of the Lincoln University Seed Research Centre. He completed an MAgSc. degree in Plant Pathology at Lincoln and then a PhD in Agronomy at the University of Nottingham, UK. His research interests include conventional and organic seed production and seed quality. In 2006 he was made a Fellow of the New Zealand Institute of Agricultural and Horticultural Science. He has been involved with ISTA for nearly 30 years, and is the current first Vice-President.

COSIMA HUFLE

Ms. Cosima Hufler chairs the Bureau of the 4th Session of the Governing Body of the International Treaty on Plant Genetic Resources for Food and Agriculture (IT PGRFA). She is senior advisor at the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management, in charge of international environmental affairs. Her particular focus is on matters related to access to genetic resources and the fair and equitable benefit-sharing arising out of their use in the context of the IT PGRFA, as well as of the Convention on Biological Diversity (CBD). In addition, she is in charge of international sustainable development issues related to the UN Commission on Sustainable Development (CSD) and the United Nations Environment Programme (UNEP). After completion of her university studies at Innsbruck and Vienna, Ms. Hufler worked as a translator. She is a graduate of the Diplomatic Academy of Vienna (with particular focus on international environmental law and institutions).

WAYNE JONES

Wayne Jones spent 18 years with the Canadian Ministry of Agriculture in various capacities as an economist, policy advisor and Director of Strategic Planning before joining the OECD 1993. He has worked in several different areas within the OECD Trade and Agriculture Directorate including policy monitoring and evaluation, food safety regulatory issues and agricultural development. He currently heads the Agro-Food Trade and Markets Division, responsible for the Secretariat's medium-term agricultural outlook as well as its analysis of various agricultural and trade policy issues.

ROLF JÖRDENS

Rolf Jördens obtained a diploma in agricultural economics from the University of Stuttgart-Hohenheim, Germany and a doctorate from the same Institute, followed by a two-year research position at the Institut National Agronomique in Paris, France. From July 2000 he has been Vice Secretary-General, International Union for the Protection of New Varieties of Plants (UPOV). Previous positions included the presidency of the German Federal Office of Plant Varieties (Bundessortenamt), Hanover, Germany from July 1997 to June 2000, with overall responsibility for variety testing, plant breeders' rights and listing of varieties. He occupied various positions in the German Federal Ministry of Food, Agriculture and Forestry, and worked in the Office of the Federal Chancellor from May 1976 to July 1997. He is a member of the Royal Swedish Academy of Agriculture and Forestry and the German Society of Agriculture (DLG).

JOHN KEDERA

John Kedera holds a PhD (plant pathology-minor plant breeding). From May 1997 he has been Managing Director of the Kenya Plant Health Inspectorate Service (KEPHIS). KEPHIS is a state corporation mandated to undertake plant protection, plant variety protection, seed certification, fertilizer, soil, water and pesticide formulation and residue analysis including environmental monitoring. From 2006 to 2008 he chaired the Commission on Phytosanitary Measures (CPM), a global forum taking decisions on phytosanitary issues and in particular the development and adoption of International Standards for Phytosanitary Measures (ISPMs) and he is currently Vice-Chairman. From 2006 to 2008 he chaired the Annual Meetings of the OECD Seed Schemes, where he is currently Vice-Chairman. These Schemes provide an international framework for the certification of agricultural seed movement in international trade. He has been a member of the Central Advisory Service Board to the CGIAR on Intellectual Property Rights since 1999 and is also Chairman of the Kenya National Taskforce on Horticulture.

CHANG HYUN KIM

Chang Hyun Kim is Director General of the Korea Seed and Variety Service (KSVS) of the Ministry for Food, Agriculture, Forestry and Fisheries (MIFAFF). He obtained a BA degree from the Department of Agricultural Education, Seoul National University in 1979 and an MA degree from the Department of Agricultural Economics at Ohio State University in 1992. He has served as Director of the Quarantine Planning Division, National Plant Quarantine Service (NPQS), MIFAFF; Director, General Division of International Cooperation at the International Agriculture Bureau, MIFAFF; Agricultural Attaché, Embassy of the Republic of Korea to the FAO, Ministry of Foreign Affairs and Trade; Director at the Office for Government Policy Coordination; Director of the Plant Variety Protection and Variety Testing Divisions at the Korea Seed and Variety Service.

JOEP LAMBALK

Joep Lambalk holds a degree in plant biochemistry and plant molecular biology from the Free University of Amsterdam. Upon graduation in 1987 he started work with Enza Zaden as their first plant biotechnology researcher. After a career of more than 22 years with the company he is currently Managing Director for Research and Development.

MICHAEL LARINDE

Michael Larinde is Senior Officer (Seed Production), Plant Production and Protection Division, FAO, Rome. He obtained a BSc. in agricultural biology from the University of Ibadan, Nigeria and an MSc. and PhD in agronomy/seed technology from Mississippi State University, US. He worked for 12 years with the West Africa Rice Development Association (WARDA), Monrovia, Liberia as the Officer-in-Charge of the WARDA regional seed laboratory and had key responsibilities for rice germplasm exchange between WARDA and various international centers and countries as well as conducting yearly seed training courses for participants drawn from 14 WARDA member countries. He joined the FAO 21 years ago and has held progressively responsible positions – first as Chief Technical Advisor (CTA) of the Guyana Seed Project (1987 to 1992); from 1992 to 1997 he was the CTA of the regional seed project for the 14 Island Countries of the Caribbean, during which period he was responsible for advising the governments of CARICOM on issues related to the seed industry. During these periods, he was involved in the development of the seed program of the 14 CARICOM countries and for providing training in different areas of seed program development. From 1998 to date, he has worked in the Seed and Plant Genetic Resources Service of FAO, Rome, where he offers extensive services and consultations to FAO member countries at global level. From 2002 to date he has been the FAO contact point with major international organizations dealing with seed.

BERNARD LE BUANEC

Bernard Le Buanec was born in 1943 and is an engineer in agronomy, having studied at the French Institute, Paris-Grignon. He has an MSc. in Soil Science and a PhD in Plant Biology. After 10 years in public research as an agronomist in several African countries he joined the Group Limagrain seed company in 1976, where he worked in various posts. When he left Group Limagrain in 1993 he was Corporate Research Director. In 1993 he joined the International Association of Plant Breeders (ASSINSEL) and the International Seed Trade Federation (ISF) as Secretary General. He organized the merger of the two organizations into the International Seed Federation (ISF) in 2002 and remained Secretary General of that organization until 2008 when he retired. Bernard Le Buanec is a member of the French Academy of Agriculture and a founding Member of the French Academy of Technology.

JOËL LÉCHAPPÉ

Joël Lechappé graduated from the Universities of Nantes and Rennes, France in botany, zoology, ecology, biochemistry and plant physiology in 1981. He gained a PhD in plant pathology (root diseases on Phaseolus) in 1986 from the University of Rennes. Joining INRA (National Institute for Agronomical Research) in 1987 in the Group for Study and Control of Varieties and Seeds (GEVES), he started his career as head of the Germination Laboratory of the National Seed Testing Station. He made contact with ISTA in 1987 with Professor Lennart Kähre in Uppsala and since then he has contributed to ISTA's work via the Germination, Proficiency Test, Vigor and Rules Committees. His current interests are in seed quality, involving technical, applied research and regulatory aspects. The post of Technical Auditor for accreditation bodies such as UKAS, UK or forming part of the ISTA team of technical auditors offers him a great opportunity to learn and exchange views on the situation in the seed world. He has been Director of the National Seed Testing Station (SNES-Angers-France) since 1993 and a Member of the Executive Committee of ISTA since 2001.

PÄIVI MANNERKORPI

Ms. Päivi Mannerkorpi is an agricultural engineer with a PhD awarded in 1990 in animal nutrition from the University of Kiel, Germany. She worked on research in animal and grassland production at the Agricultural Research Centre of Finland from 1991 to 1994; she was Senior Officer and head of the Animal Nutrition Section at the Ministry for Agriculture and Forestry, Finland from 1994 to 2001. She headed the Policy and Legislative Unit including performance guidance of control authorities (animal nutrition and plant production including organic agriculture and biotechnology) at the Ministry for Agriculture and Forestry, Finland from 2001 to 2004 and she joined the European Commission, Directorate-General on Health and Consumers in 2004 as policy officer (EU legislation and policies on GMOs, novel foods, cloning, nanotechnology). Since 2008 she has headed the Material for Plant Reproduction in Unit Biotechnology and Plant Health Sector.

MICHAEL MUSCHICK

Michael Muschick is an agricultural biologist from the University of Stuttgart-Hohenheim, Germany. He holds a master's degree in biotechnology and a PhD in plant biochemistry from the ETH Zurich, Switzerland. After working on developing aid projects in Africa and research projects in plant breeding in Switzerland, he joined the International Seed Testing Association (ISTA) as Executive Officer in 1999 and became Secretary General in 2001. He was a member of the organizing committee of the 1st World Seed Conference in Cambridge, UK in 1999.

WILLIAM NIEBUR

As DuPont Vice-President for Crop Genetics Research and Development at Pioneer Hi-Bred International, William Niebur drives worldwide crop genetic research strategies to create new values for seed and agricultural value chain customers through advanced plant genetics. He has extensive global experience in plant genetics and biotechnology, having served in research director positions in both the US and Europe. In his current role he has been instrumental in integrating two new and proprietary technologies, gene shuffling and marker-assisted selection, into DuPont's plant genetics product development. During his 25-year career with Pioneer, he has been granted several patents that have led to the commercialization of more than 30 Pioneer® brand products. He has been instrumental in negotiating international research collaborations as well as the 2004 acquisition of Verdia. He holds BSc. and MSc. degrees from Iowa State University and earned his doctorate in plant breeding and cytogenetics from the University of Minnesota, US. In 2006, he was appointed Chair of the Private Sector Committee of the Consultative Group on International Agricultural Research, an organization that works to achieve sustainable food security and reduce poverty in developing countries through scientific research.

SHIVAJI PANDEY

Shivaji Pandey was born and raised in India. He obtained his MS and PhD in plant breeding and plant genetics from the University of Wisconsin, US and worked for over 30 years in international agricultural research and development, serving as a scientist, Regional Representative for South America, Director of the Maize Program and Director of the African Livelihoods Program at the International Maize and Wheat Improvement Center (CIMMYT) in Mexico and in its outreach programs. In 2005, he joined FAO as Director of Agricultural Support Systems Division (AGS). In 2006, he was appointed Director of their Plant Production and Protection Division (AGP) to lead work on increasing production and quality of all food and non-food crops to enhance food security and livelihoods especially of the rural and urban poor. The work of the Division involves conservation and sustainable use of plant genetic resources, seed production, development and deployment of improved cultivars, use of appropriate agronomic practices, cropping systems, conservation agriculture, organic farming and integrated pest management, etc. International treaties and commissions such as IT PGRFA, GPA (Global Plan of Action), IPPC (International Plant Protection Commission), International Code of Conduct on Pesticides and the Rotterdam Convention also form part of the Division's work. He chairs the Inter-Departmental Working Group on Biotechnology at FAO which integrates the research, development, and policy work on biotechnology of the Organization for agriculture, forestry and fisheries. Honors and awards received include a DSc. from the Maharana Pratap University of Agriculture and Technology, India. He is also a Fellow of the American Society of Agronomy; a Fellow of the Crop Science Society of America and has received special recognitions from the governments of Bolivia, Colombia, Ecuador and Vietnam. He has authored or co-authored over 150 publications.

ALISON POWELL

Dr. Alison Powell began her work on seed quality during her PhD, working on the physiological basis of seed quality in *Pisum sativum* (garden pea). This basic research was extended to a wide range of temperate and tropical grain legumes and small seeded vegetable species during her career in teaching and research at the universities of Stirling and Aberdeen in Scotland. Much of her research has been in collaboration with postgraduate students and visiting scientists from Asia, Africa and South America as well as Europe. Taking research from science into practical use has been an important aspect of her work. One practical outcome was the electrical conductivity test for peas becoming one of the first two vigour tests to enter the ISTA Rules. This will be followed by the application of the test

to Phaseolus beans and soybeans. Recently, along with colleagues in the ISTA Vigour Committee, which she chairs, she has guided the controlled deterioration vigour test for Brassica species into the ISTA Rules. The physiological basis of these tests is supported by her extensive publications in international journals. She has retired from her post at the University of Aberdeen and was awarded a DSc. in 2005 in acknowledgement of her research contribution to seed science. She is a member of the ISTA Executive Committee and has been on the Editorial Board of three international plant science journals (*Annals of Botany*, *Journal of Experimental Botany*, *Seed Science and Technology*) for many years. Since 2002, she has been the Seed Symposium Convenor for the triennial ISTA Congress, which will next be held in Cologne, Germany in June, 2010.

MICHAEL RYAN

Michael Ryan holds a PhD in agricultural economics (international trade and finance) from the University of Alberta, Edmonton, Canada, and an MAgSc. from University College Dublin, Republic of Ireland. Prior to joining OECD in 1992, Mr. Ryan worked as an agricultural policy analyst in the Canadian Ministry of Agriculture. Since that date he has been responsible for completing several agricultural policy reviews, has regularly contributed to the OECD Annual Monitoring Report of Agricultural Policies, and has led the work under the Baltic Regional Programme and the South East Asia Programme. In addition, he was team leader of the project on examining the policy impacts of modern biotechnology in developing countries. Michael Ryan was appointed head of the OECD Codes and Schemes in 2006.

EVANS SIKINYI

Evans Sikinyi is the head of Seed Certification and Plant Variety Protection at The Kenya Plant Health Inspectorate Service (KEPHIS). He holds a PhD degree from Iowa State University in horticulture (breeding and biotechnology), an MSc. in plant breeding and a BSc. in agriculture from the University of Nairobi. He has been key in setting up and operating the plant variety protection system in Kenya. He trained in intellectual property inter alia at Michigan State University; Cambridge, UK; WIPO/UPOV, Geneva; and the United States Patent and Trademark Office (USPTO). He is a qualified trainer in intellectual property (USPTO Global Intellectual Property Academy) particularly relating to plant variety protection. He was a key member of the task force that recently developed the seed policy for Kenya and the Vice-Chair of the task force for developing policy and laws for traditional knowledge, genetic resources and folklore in Kenya. He is a member of the Expert Advisory Committee of the Central Advisory Service on Intellectual Property for the CGIAR and is the leader of Kenya's delegation to the International Treaty on Plant Genetic Resources for Food and Agriculture. He is a member of the UPOV Council, Administrative and Legal and Technical committees and also a member of various technical working parties in UPOV. He chaired the UPOV study on the impact of plant variety protection.

M. S. SWAMINATHAN

Professor M. S. Swaminathan has been acclaimed by Time magazine as one of the 20 most influential Asians of the 20th century and one of only three from India, the other two being Mahatma Gandhi and Rabindranath Tagore. He has been described by the United Nations Environment Programme as the father of economic ecology and by Javier Perez de Cuellar, Secretary General of the United Nations, as "a living legend who will go into the annals of history as a world scientist of rare distinction". He was Chairman of the UN Science Advisory Committee set up in 1980 to follow up on the Vienna Plan of Action. He has also served as Independent Chairman of the FAO Council and President of the International Union for the Conservation of Nature and Natural Resources. He served as President of the Pugwash Conferences on Science and World Affairs (2002 to 2007) and President of the National Academy of Agricultural Sciences (2005 to 2007). A plant geneticist by training, Professor Swaminathan's contributions to the agricultural renaissance of India have led to his being widely referred to as the scientific leader of the green revolution movement. His advocacy of sustainable agriculture leading to an ever-green revolution makes him an acknowledged world leader in the field of sustainable food security. The International Association of Women and Development conferred on him the first international award for significant contributions to promoting the knowledge, skill, and technological empowerment of women in agriculture and for his pioneering role in mainstreaming gender considerations in agriculture and rural development.

Professor Swaminathan was awarded the Ramon Magsaysay Award for Community Leadership in 1971; the Albert Einstein World Science Award in 1986; the first World Food Prize in 1987; the Volvo and Tyler Prize for Environment; the Indira Gandhi Prize for Peace, Disarmament and Development in 2000 and the Franklin D. Roosevelt Four Freedoms Medal and the Mahatma Gandhi Prize from UNESCO in 2000. Professor Swaminathan is a Fellow of many of the leading scientific academies of India and the world, including the Royal Society of London and the US National Academy of Sciences. He has received 58 honorary doctorates from universities around the world. He currently holds the UNESCO Chair in Eco-technology at the M. S. Swaminathan Research Foundation in Chennai, India and was formerly Chairman of the National Commission on Farmers in the Government of India. He is currently a Member of the Parliament of India (Rajya Sabha), to which position he was nominated in May, 2007 by the Government of India in recognition of his contribution in the field of agricultural research and development. He was awarded the Padma Shri (1966), Padma Bhushan (1972) and the Padma Vibhushan (1989) by the President of India. Professor Swaminathan served as Director of the Indian Agricultural Research Institute, New Delhi from 1966 to 1972; Director General of the Indian Council of Agricultural Research and Secretary to the Government of India, Department of Agricultural Research and Education from 1972 to 1979; Principal Secretary at the Ministry of Agriculture from 1979 to 1980; Acting Deputy Chairman and later Member of the Union Planning Commission from 1980 to 1982 and Director General of the International Rice Research Institute in the Philippines from 1982 to 1988. He currently holds the UNESCO Chair in Eco-technology and is Chairman of the M. S. Swaminathan Research Foundation, Chennai, India.

YLVA TILANDER

Dr. Ylva Tilander has been Deputy Director of the Animal and Food Division of the Ministry of Agriculture in Sweden since 2004. She is responsible for coordinating international negotiations related to plant genetic resources and overall budget and planning processes. She headed the Swedish team on genetic resources during the Swedish EU Presidency in the autumn of 2009 and she also chairs the board of the Nordic Genetic Resource Center. She was previously, Senior Adviser to the Nordic Council of Ministers (Fishery, Agriculture, Forestry and Food Affairs) for policy development in the field of agriculture, forestry and food security and has provided information services to the Swedish Energy Research Commission. A writer on the environment, science and development questions for several Swedish newspapers, she holds a PhD in ecology and environmental sciences, with a specialization in ecological competition and sustainable resource use in semi-arid agro-forestry from the Swedish University for Agricultural Sciences. She has also participated in fieldwork in Burkina Faso, Tunisia and India.

ANKE VAN DEN HURK

Ms. Anke Van den Hurk has been a senior adviser at Plantum NL, the Dutch association for breeding, tissue culture, production and trade of seeds and young plants, since 2001. She is a specialist in the field of biodiversity, in particular access and benefit sharing (ABS), participating in the various meetings of the IT PGRFA and the Convention on Biological Diversity (CBD) as a representative of the breeding sector. She represents the sector in the various industry fora dealing with ABS, such as the International Seed Federation, the European Seed Association, CIOPORA, the International Chamber of Commerce. Within ISF she chairs the working group on biodiversity. Before joining Plantum NL she worked from 1996 to 2001 at the International Plant Genetic Resources Institute (IPGRI) now known as Bioversity International, in Rome and Cali, Colombia as associate expert on training in plant genetic resources and on complementary conservation strategies. From 1995 to 1996 she taught various agricultural subjects including plant breeding at Mekelle University College in Ethiopia. From 1992 to 1995 Anke Van den Hurk worked as a vegetable breeder at Nunhems Zaden in the Netherlands. She holds an MSc. degree in plant breeding from the Wageningen University and has worked on taxonomy, plant breeding in Ethiopian barley landraces and growth models.

JOOST VAN DER BURG

Alumnus of Wageningen University, Joost van der Burg started his professional career at the government Seed Testing Station in Wageningen, Netherlands, as head of several departments. During this period he contributed extensively to the development of the International Rules for Seed Testing (the ISTA Rules). Ten years later he moved to the position of Leader of the Seed Technology Section dur-

ing which he was involved at the start of some of the developments such as non-destructive quality determination of seeds. During his career he has traveled extensively in temperate and tropical countries. Over the last decade he has been responsible for a number of research and development programmes and projects to support agriculture and horticulture in developing countries many of which involved seed quality, seed production and legislation. Joost van der Burg is currently the Netherlands' official representative at ISTA and member of the ISTA Advanced Technologies Committee. He is Senior Seed Scientist and Tropical Botanist at Plant Research International in Wageningen.

BERT VISSER

Bert Visser was born in the Netherlands in 1951. He obtained an MSc. degree in Molecular Sciences at Wageningen University in 1976 and in 1982 obtained a PhD at the University of Utrecht in the Netherlands in the area of medical virology. He then worked in the Agricultural Research Department of the Ministry of Agriculture, Nature and Food Quality as a plant biotechnologist. In 1992 he joined the Ministry of Foreign Affairs as a senior officer in the Special Programme Biotechnology and Development Cooperation, where he is in particular responsible for capacity building. Since 1997 he has been Director of the Centre for Genetic Resources, the Netherlands (CGN), which - under its own mandate - is part of Wageningen University and Research Centre. As the Director of CGN he fulfils an advisory role for the Ministry of Agriculture, Nature and Food Quality on policies regarding (agro-)biodiversity. In this capacity he has been a regular member of the delegations to FAO and the CBD. Furthermore he functions as the national focal point for the implementation of the Global Plan of Action on PGRFA, and has been appointed as the National Focal Point on Access and Benefit Sharing of the CBD. His interests and activities concern genetic resource management and policy development, international collaboration in the area of genetic resource management, on-farm conservation of genetic resources and the interface of agro-biodiversity and biotechnology.

DOUG WATERHOUSE:

Doug Waterhouse is a graduate in botany and forestry from the Australian National University where he specialized in quantitative genetics. His research career began in the Research School of Biological Sciences, where he worked on the forerunner to "climate change". In 1978 he moved to the Department of Agriculture as part of the Lucerne Breeding Team and released the widely acclaimed series of varieties starting with 'Nova', 'Aurora' and 'Aquarius'. In the 1990s he turned his attention to conservation issues and joined the then Department of Conservation and Land Management to direct their programs related to revegetation and salinity control including work on developing more than 100 native and introduced species for land and water reclamation. After a period as the senior examiner, he has for the last 15 years been Chief of the Australian Plant Breeder's Rights scheme and the Chairman of the Plant Breeder's Rights Advisory Committee. He has been a regular participant in UPOV's Technical Committee and is current President of the UPOV Council.

RITA ZECCHINELLI

Ms. Rita Zecchinelli is from Italy. She graduated at the University of Milan in agricultural science with a degree thesis on seed germination physiology. In 1985, she joined the Ente Nazionale Sementi Elette (ENSE), the Italian public body which carries out seed certification on behalf of the Ministry of Agriculture and Forestry. She has been working in the Seed Certification Unit in Milan for 13 years, being involved in field inspections, seed sampling and other tasks related to seed certification in different species (cereals and forage crops in particular). In 1998, she moved to the Seed Testing Laboratory in Tavazzano, becoming the head of the station and still holds the same post. As head of the laboratory, she is engaged in seed testing, including traditional tests such as germination, purity, moisture content determination, variety and GMO tests, all of which are at present included in the laboratory's scope of ISTA accreditation received in 2000. The laboratory is also a member of the ENGL (European Network for GMO Laboratories). At national and international level, Rita Zecchinelli has been and is a member of different committees and boards working on subjects related to seed certification and seed testing. She has been a member of the Executive Committee of ISTA since 2004 and of two ISTA technical committees (the Proficiency Test Committee and the Flower Seed Committee). As Vice-Chair of the Flower Seed Committee, she is co-editor of the ISTA Handbook for Flower Seed Testing, published in 2008. Since 2006 Rita Zecchinelli has also been an ISTA technical auditor.

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