GLOBAL CHALLENGES REPORT
FOOD SECURITY AND INTELLECTUAL PROPERTY

How the Private and the Public Sectors Use Intellectual Property to Enhance Agricultural Productivity

Proceedings of a Seminar
at the World Intellectual Property Organization (WIPO)
Geneva | June 14, 2011

WIPO
WORLD INTELLECTUAL PROPERTY ORGANIZATION

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Background

Seminar on How the Private and the Public Sectors Use IP to Enhance Agricultural Productivity

One of the reasons for hunger and malnutrition in many developing countries is insufficient agricultural productivity which does not keep pace with increasing demand for food due, essentially, to population growth. There is a lack of incentives to develop or to introduce appropriate agricultural technology, including better adapted varieties of plants. Experience shows that the public sector alone, for various reasons, is unable to respond to the needs of farmers for suitable agricultural technology. There is ample evidence that a suitable legal and administrative framework of intellectual property protection may provide a key incentive for creativity, investment and knowledge transfer in many different circumstances and in agriculture in particular, for both, the public and the private sectors.

WIPO as the leading institution for intellectual property protection has a major responsibility to raise awareness on how IP can stimulate innovation, investment and knowledge transfer for food security and to assist in creating a suitable legal and administrative framework in developing countries with that objective.

A series of public events is planned with a view to demonstrate IP driven success stories of agricultural development with a particular focus on food security. A coordinated action is intended with selected partners from the plant related innovation industry, the public agricultural research sector, farmers associations of selected developing countries, relevant intergovernmental (FAO, UPOV), non governmental organizations and potential donors. A first Seminar was held on June 14, 2011, at the WIPO Headquarters in Geneva.

The Seminar was moderated by Mr. Rolf Jördens, Special Advisor, Global Issues Sector, WIPO, who is also the editor of the proceedings.

The slides contained in this brochure are also available on the following website:
http://www.wipo.int/meetings/en/2011/wipo_ip_lsbiot_ge_11/program.html

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Seminar on How the Private and the Public Sectors Use Intellectual Property to Enhance Agricultural Productivity

Geneva, June 14, 2011

PROGRAM
prepared by the International Bureau of WIPO

Tuesday, June 14, 2011

9.00 – 9.30	**Registration**		
9.30 – 9.45	**Opening Remarks by:** Mr. Francis Gurry, Director General, World Intellectual Property Organization (WIPO), Geneva		
9.45 – 10.10	**The Global Status of Food Security and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)**		
	Speaker:	Mr. Shakeel Bhatti, Secretary, International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), Food and Agriculture Organization (FAO), Rome	
10.10 – 10.35	**Technology, Food Security and Sustainable Development**		
	Speaker:	Mr. Christophe Bellmann, Programmes Director, International Centre for Trade and Sustainable Development (ICTSD), Geneva	
10.35 – 11.00	Coffee Break		
11.00 – 11.30	**Which Technology do African Farmers Need?** *[Presentation canceled]*		
	Speaker:	Mr. Anthony M. Kioko,Programs/Operations Manager, Cereal Growers Association (GRA), Nairobi	
11.30 – 12.00	**Which Technology do African Farmers Need?**		
	Speaker:	Dr. Stephen Mbithi Mwikya, Chief Executive Officer, Fresh Produce Exporters Association of Kenya (FPEAK), Nairobi	
12.00 – 12.30	**Public Agricultural Research in South Africa – the Role of Intellectual Property Protection**		
	Speaker:	Dr. Shadrack R. Moephuli, Chief Executive Officer, Agricultural Research Council (ARC), Pretoria	
12.30 – 14.00	Lunch Break		

14.00 – 14.30	**Analysis of Opportunities and Challenges in Intellectual Property Rights and Agriculture in the Indian Context** Speaker: Dr. Sudhir Kochhar, National Coordinator (Component 4), Basic and Strategic Research, Project Implementation Unit (PIU), National Agricultural Innovation Project (NAIP), Indian Council of Agricultural Research (ICAR), New Delhi
14.30 – 15.00	**How a Global Player in Agricultural Biotechnology Uses Intellectual Property (IP): Syngenta's New Approach to Technology Transfer** Speaker: Dr. Michael Andreas Kock, Global Head Intellectual Property, Seed and Biotechnology, Syngenta International AG, Basel
15.00 – 15.30	**The Role of IP for Successful Plant Breeding and for the Availability of New Plant Varieties to the Farmer** Speaker: Dr. Marcel Bruins, Secretary General, International Seed Federation (ISF), Nyon
15.30 – 16.00	Coffee Break
16.00 – 16.30	**The Importance of Public-Private Partnerships: Findings of an International Union for the Protection of New Varieties of Plants (UPOV) Seminar in April 2011** Speaker: Mr. Peter Button, Vice Secretary-General, International Union for the Protection of Varieties of Plants (UPOV), Geneva
16.30 – 17.00	**Discussion and Conclusion: The WIPO Forum IP and Food Security** Speaker: Mr. Johannes Christian Wichard, Deputy Director General, World Intellectual Property Organization (WIPO), Geneva
17.00 – 17.15	Closing of Seminar

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Opening remarks by Dr. Francis Gurry, Director General, World Intellectual Property Organization (WIPO)

Ladies and Gentlemen,

Distinguished speakers and participants,

Dear colleagues,

I should like to thank you for attending our **Seminar on How the Private and the Public Sectors Use IP to Enhance Agricultural Productivity** and wish to extend a warm welcome to all of you.

Among the challenges which humankind is facing today food security is probably one of the most urgent ones. Currently, around one billion people in the world are suffering from hunger. Most of them are living in rural areas of developing countries, particularly in Africa. It is estimated that food production needs to increase by 70% to feed a world population which is expected to reach nine billion by 2050. Hunger is not only a deeply unjust and inhumane phenomenon in a modern world. Food shortage and rising prices can easily become a cause of civil unrest and a threat to stability of societies. Furthermore, climate change is expected to complicate the task.

There is no doubt that the response has to come from agriculture, essentially. However, the answer is not simply to produce more food with more inputs. More food needs to be produced in a sustainable way. In most countries there are limits for expanding farmland. We have to preserve nature and the environment. Therefore, agricultural productivity needs to be increased with the same level of inputs or, better, with reduced inputs such as land, water, fertilizer and pesticides.

Thus, improved agricultural inputs, technology and know how need to be developed and made available to farmers in Africa, in particular. Appropriate incentives are required to develop and to introduce suitable agricultural technology, including better adapted varieties of plants. There is evidence that a balanced legal and administrative framework of intellectual property protection may provide a key incentive for innovation, investment and knowledge transfer in many different circumstances and in agriculture in particular, for both, the public and the private sectors.

WIPO as the leading institution for intellectual property protection has a major responsibility to raise awareness on how IP can stimulate innovation, investment and knowledge transfer for food security and to assist in creating a suitable legal and administrative framework in developing countries with that objective.

Therefore, we are planning to organize a series of public events to explore how IP can be used for agricultural development with a particular focus on food security. A second seminar is tentatively scheduled for the late fall of this year, more may follow in the next biennium. These events may lead to a coordinated action with partners from various backgrounds, including the plant-related innovation industry, the public agricultural research sector, farmers associations of selected developing countries, relevant intergovernmental (FAO, UPOV), non governmental organizations and potential donors.

From the presentations and discussions during this first meeting we hope to collect some facts on how important stakeholders see the role of IP in respect of food security. We will explore whether, on that basis, WIPO can act as a catalyst for cooperation among some of the partners who are represented today and others who may wish to join. WIPO would be very pleased to provide not only a forum for further discussion, but also to encourage practical cooperation with and among stakeholders I am convinced that the IP system offers a big untapped potential for successfully addressing issues of food security.

Coping with food security against the background of a growing world population, scarcity of natural resources and climate change is a tremendous task. We need to join our efforts and WIPO is ready to contribute.

I wish all of us a fruitful meeting.

Thank you very much.

The Global Status of Food Security and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) – Transcription of Oral Presentation by **Dr. Shakeel Bhatti, Secretary, ITPGRFA, Food and Agriculture Organization of the United Nations (FAO), Rome, Italy**

As a representative of the Food and Agricultural Organization of the United Nations (FAO), I would like to congratulate WIPO on the initiative to organize this seminar. It is a most welcome initiative. I was asked to give an initial overview about the challenges in relation to food security and I would like to focus on a particular aspect and that is how to adapt agriculture to climate change. Within that I would like to focus on the key role of climate ready crops. Without climate resilient crops food security in the future will be severely at risk.

I shall deal with that emerging global challenge in three parts:

1. some facts and recent developments on food security in relation to climate change; then,
2. the role of the International Treaty on Plant Genetic Resources for Plant Genetic Resources for Food and Agriculture (the Treaty) as a tool for adaptation of agriculture in the face of climate change; and finally,
3. one of the core elements of the Treaty – the Benefit Sharing Fund, which has chosen climate change as its thematic focus

Some facts

The 2008 food price spikes pushed about a hundred million people worldwide into food insecurity, malnutrition and poverty. Just this year while that immediate crisis is over there is a kind of protracted crisis because again more than 44 million people have experienced that same fate. Some forecasts to which Director General Francis Gurry has just referred indicate that during the coming two decades real food prices for staple grains will rise in a range between 120 to 180 per cent. That stands in contrast to the fact that between 1983 and 2006 the share of agriculture in international development aid has dropped from 20.4 to 3.7 per cent. By 2050 there will be 9 billion people on the planet and food demand will consequently rise by 70 per cent. This demand will have to be met despite the impact of climate change. At the same time agriculture is a significant anthropogenic cause of climate change. 30 per cent of greenhouse gases emissions come from agriculture, in particular from livestock. Climate ready seeds, and therefore the International Treaty, have a key role to play in a climate resilient agriculture.

I would like to conclude this overview with a reference to some forecasts; it was estimated that food prices would increase in the range of 70 to 90 per cent by 2030 before the effect of climate change. That is the difference between these two bars which you see for the different crops here.

The role of the International Treaty

The International Treaty operates a few key systems that are directly under the control of the Governing Body of the Treaty. Those are the Multilateral System of Access and Benefit Sharing for Plant Genetic Resources for Food and Agriculture and the Benefit Sharing Fund. Those two systems are closely interlinked. Together they provide the tools to deliver to countries and the agricultural sector a bundle of key inputs which they need in order to adapt to Climate Change: firstly , facilitated access to plant genetic resources; secondly, the non-monetary benefit sharing mechanisms under the Treaty of technology transfer and exchange of scientific information; and, thirdly, adaptation financing which is actually provided through the Benefit Sharing Fund. These three inputs in conjunction provide a package for food security maintenance within the climate change impact. The inputs are delivered through the core systems and facilitate plant breeding as well as the conservation and sustainable use of the plant genetic diversity that underlies all plant breeding and, in particular, the development of climate ready crops. So, abstracting from the technical systems, the inputs that the Treaty overall will be able to provide is seeds, technology and financing for insuring food security within and through adaptation of crops to climate change.

How does the Treaty deliver those inputs? Essentially, this is a simplified description of the core systems: The Multilateral System creates a global gene pool which we have launched about four years ago, in which we have by now included about 1.5 million samples of plant genetic material. This material is contributed by the States who ratified the Treaty, the Contracting Parties, by natural and legal persons including the whole range of legal persons from private sector companies to farming communities, by International Organizations such as the International Atomic Energy Agency which has included its mutant germplasm repository, and “Others” which refers essentially to the CGIAR Centers, the International Agricultural Research Centers.

Once that material is included by the provider it is transferred under standard contract to the recipient. Provider 1 transfers the material under a Standard Material Transfer Agreement to the recipient 1 who takes on the obligation only to transfer this material again with the same terms and conditions, who becomes, therefore, provider 2, transfers it under SMT 2 to recipient 2 who becomes provider 3 and transfers it on etc. This, over a long product development cycle in plant breeding, leads in some cases to a commercial product that may be offered for sale in the market. If that product is not available without restriction for further research, training and breeding the recipient shall pay 1.1 per cent of all net sales minus 30 per cent of that product, which incorporates genetic material from the system, to the Benefit Sharing Fund. The Fund is also fed by other, voluntary, contributions made by Contracting Parties and International Organizations, by the private sector and by others, such as philanthropist foundations.

The Fund then disburses these resources according to multilaterally, internationally, agreed funding priorities, eligibility criteria and operational procedures. The Governing Body has adopted three funding priorities: On-farm conservation and management of plant genetic resources; sustainable use, including for climate change adaptation of crops and, thirdly, technology transfer and information exchange. These priorities, in turn, conserve the plant genetic diversity that feeds the gene pool which is a basis for plant breeding which generates new products and, thereby, benefits which can be shared. It is a kind virtual cycle.

In the past four years we have implemented that system to the point were we have about 600 to 800 transfers of genetic material every day worldwide. We have capitalized the Benefit Sharing Fund and placed a call for proposals at about 14 million Dollars. We are now about to disburse at least 10 million Dollars directly for climate change adaptation research and conservation work and breeding. This whole system is governed multilaterally, transparently by the Governing Body of the Treaty.

Where are the intellectual property linkages? I would like to focus on that ring [on the slide] around the product which is the IP dimension of the system. It symbolizes an entire IP management model that is built into the Multilateral System of Access and Benefit Sharing. We look here just at the benefit sharing side, not on the access side. If the product is not available without restriction for further research, breeding and training, in other words, if it is under a patent claim, then there are two options. One is a product based benefit sharing scheme which provides that about 0.77 per cent or 1.1 per cent minus 30 per cent, of net sales of the product is paid to the Benefit Sharing Fund. The alternative is a crop based scheme where the recipient shall pay a lower percentage, 0.5 per cent, of the sales of any plant genetic resource product belonging to that same crop which was accessed from the Multilateral System regardless of whether that crop is under an IP restriction or not. In addition there are, as already mentioned, voluntary contributions. Indeed, germplasm based payments have already been made to the Fund on a voluntary basis. These resources go to the Benefit Sharing Fund of the Treaty.

What is the policy objective of benefit sharing in the context of the International Treaty and food security? Because these genetic resources are pooled there is no individual owner with whom an individual contract for access and benefit sharing could be negotiated. This means that the Treaty lowers transaction costs for access to the genetic material. It also means that the benefit sharing, just like the access, is multilaterally agreed. The purpose of the benefit sharing is to encourage conservation. So, we wish to preserve genetic diversity by encouraging farmers to conserve the existing diversity on farm, *in situ*. The Benefit Sharing Fund which is the vehicle for that process was established almost two years ago to invest in high impact projects supporting small holder farmers in developing countries who conserve and sustainably use that genetic diversity. There is a clear focus on food security and adaptation of crops to climate change as well as conservation of agro biodiversity. Financial support has been received by countries such as Spain, Italy, Norway, Switzerland, Indonesia, Kenya and Australia. Furthermore, IFAD has just invested 1.5 million Dollars; UNDP has committed 10 million Dollars to the call for proposals of the Fund. The fundraising which I have done is actually gaining momentum and there is growing interest in contributing to the Fund.

The first project cycle was launched in 2008/2009. We received within about six weeks more than 400 pre-proposals from agricultural stakeholders throughout the world. Here you see the distribution of those applications. The highest percentage was in Africa with 32 per cent; after that Latin America 26 per cent; then Asia 25 per cent and so on. In the first project cycle 11 projects were approved. The regional distribution is shown here.

Several of the projects are specifically aimed at climate change adaptation and I would like to give you two examples: the first one is from Cost Rica. The main objective is to characterize novel, yet unexploited, germplasm of potato and to identify accessions adapted to biotic and abiotic stresses caused by global climate change - old genes coping with new challenges.

The activities comprise: (1) establishment of a germplasm collection of potato wild species from Costa Rica which otherwise go undocumented, uncharacterized and unconserved and are rapidly lost, precisely through the impact of climate change; (2) evaluation of accessions for resistance, or tolerance, to biotic and abiotic stresses caused by climate change; (3) identification of useful candidate genes for those biotic and abiotic stresses applying different molecular tools; (4) pre-breeding activities to combine favorable characteristics and improve adaptation traits. There is a strong technology transfer component in this project. That concerns the evaluation of resistance or tolerance to pathogens; evaluation of resistance or tolerance to abiotic stress factors such as drought, cold and heat; differential seed DNA mapping; application of those same technologies to detect transcripts with differential expression; analysis of known candidate genes for those stresses; design of primers based on comparative sequence information to obtain amplication products via PCR, etc. That work is undertaken to achieve the following impacts: (1) locally: a germplasm collection of potato wild species identified and breeding lines, progenitors and varieties for drought, cold and heat tolerance which can serve to produce new commercial varieties; useful genes related to drought, heat and cold resistance or other tolerances identified; a set of useful markers for marker assisted breeding and functional biodiversity conservation; a setup of an official in-vitro collection of potato wild species, breeding lines and varieties at the University of Costa Rica; (2) globally: conservation and sustainable use of potato wild relatives and the production of novel potato varieties with resistance and tolerance to extreme climatic conditions such as flooding, drought, heat, and cold, and biotic stresses such as pests and diseases. The purpose of these projects is to conserve and document the plant genetic diversity on-farm, *in situ*, in order to be able to adapt potato production globally by identifying the climate adaptation traits that we will all need globally. These projects, consequently, have found a lot of interest also from other agencies, from contracting parties and also from the private sector.

Another example is a project in Peru where we are supporting the conservation and sustainable use of native potato diversity in a potato park in Cuzco. That park has been established by Quechua farming communities where they hold a collection of 1,345 native potato varieties. The objective is to adapt the potato park to climate change in the Andes. In that park a very high concentration of potato diversity is preserved in a terrace cultivation system according to its agro climatic requirements; through the local impact of climate change the temperature zones are shifting to higher altitudes. Consequently, in order to preserve diversity, the respective varieties need to be transplanted accordingly. Thus, the project contributes to that conservation work which we will all need to draw upon in the future. The local communities are cooperating with the International Potato Center (CIP) in Lima to characterize that diversity.

Zooming out again to the project cycle: while food security was an underlying concern for all the projects, the challenges that were addressed specifically by the projects of the first round were in 27 per cent purely climate change adaptation, 18 per cent purely food security and 55 per cent on agro biodiversity conservation. The Strategic Plan for the capitalization of the Benefit Sharing Fund that I developed with the *ad hoc* Advisory Committee on the Funding Strategy foresees that we capitalize the Fund at 116 million Dollars over a period of five years. I am actually ahead of that plan; it foresaw that by the end of last year we would have mobilized 10 million Dollars. Actually, we had mobilized 14 million Dollars. Currently, we are beyond 15 million Dollars. The plan foresees 75 per cent of contributions to come from Contracting Parties, one per cent to come from non-Contracting Parties, 11 per cent from the private sector and from philanthropists. The second call for proposals related to specifically keeping crops and farmers ahead of the climate change curve.

The call for proposals 2010 was for a minimum of 10 million Dollars co-sponsored by UNDP and others, as already mentioned. I would like to highlight two factors, in particular: one is that Norway has committed to pay 0.1 per cent of all net seed sales in Norway annually to the Benefit Sharing Fund – a voluntary initiative of a specific country according to its own means. The second factor is that, increasingly, countries such as Indonesia and Kenya are also investing in the Fund which reflects the priority which they attach to the Fund and its mechanism as both, recipients and donors. The second call for proposals with its focus on climate change adaptation was based on high level expert advice that I sought in order to conceptualize the strategy of the Fund. That expert team included Dr. Roberto Acosta who is the head of the United Nations Framework Convention on Climate Change, Secretariat Department of Adaptation; Dr. Geoffrey Hawtin who was a Director General of several CGIAR Centers and the founding Chief Excecutive Officer of the Global Crop Diversity Trust; Professor Swaminathan and others. They have designed the strategy that is now being used to disburse about 10 million Dollars in two windows. Window 1 focuses on so called Strategic Action Plans: Strategic Action Plans are designed on an agro ecological zone basis to reflect a focused medium term adaptation strategy for those food crops that are most important for food security globally and in the region concerned. By consulting the local stakeholders and downscaling global climate change models to anticipate future impact in that agro ecological zone a focused strategy for that region is designed. In this biennium we are funding only the planning, the strategic development, customized for each region. In the next biennium we will fund the implementation. In the third biennium we will fund the rounding of the implementation and the evaluation of the strategy. Window 2 focuses on immediate impact projects.

With this the International Treaty is seeking to produce a package of multiple inputs of climate ready seeds, technology transfer for adaptation technology and customized adaptation financing in order to create climate resilient crops for food security in an era of agriculture under climate stress.

The International Treaty

ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

The Global Status of Food Security and the International Treaty on Plant Genetic Resources for Food and Agriculture

Dr. Shakeel Bhatti
Secretary, IT-PGRFA

WIPO Seminar on How the Private and Public Sectors Use IP to Enhance Agricultural Poductivity
Geneva, 14 June 2011

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- Facts and recent developments of food security and climate change
- The International Treaty on Plant Genetic Resources and its Benefit-sharing fund as mechanisms to address such global challanges
- The First Project Cycle of the BSF
- The Strategic Plan for the implementation of the BSF of the Funding Strategy of the Treaty
- The Second Project Cycle of the BSF

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Introduction: Facts and figures on food security and climate change

- The 2008 food price spike pushed 100 million people into food insecurity and poverty.
- Price rises in 2011 so far have done the same of 44 million people
- Forecasts indicate real food prices to rise for staple grains in range of 120% to 180% in next 2 decades
- Between 1983 and 2006, the share of agriculture in aid fell from 20.4% to

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Introduction: Facts and figures on food security and climate change (2)

- By 2050 there will be 9 billion people on the planet and demand for food will rise by 70%. This demand must be met despite increasing competition over land and climate change impact on agriculture
- Upto 30% of greenhouse gas emissions come from World
- Need to create a climate-resilient agriculture – climate-ready seeds have a key role to play

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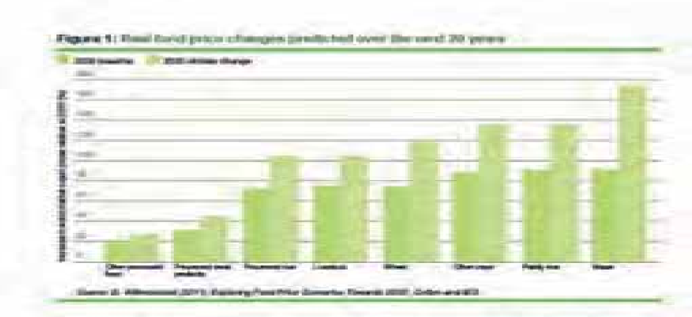
Introduction: Facts and figures on food security and climate change

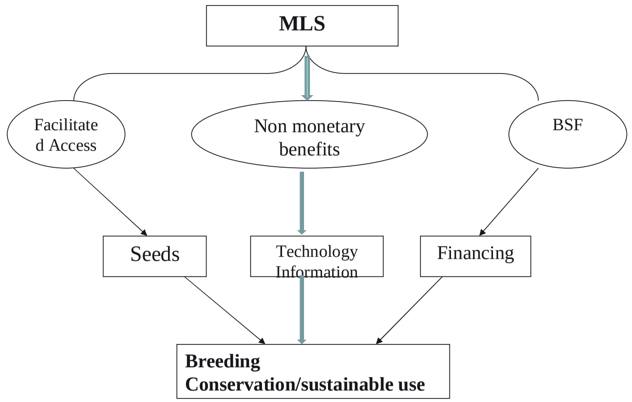


"...food prices are forecast to increase by something in the range of 70 to 90% by 2030 *before the effects of climate change..." (2011, Oxfam)*

Introduction: Facts and figures on food security and climate change (3)

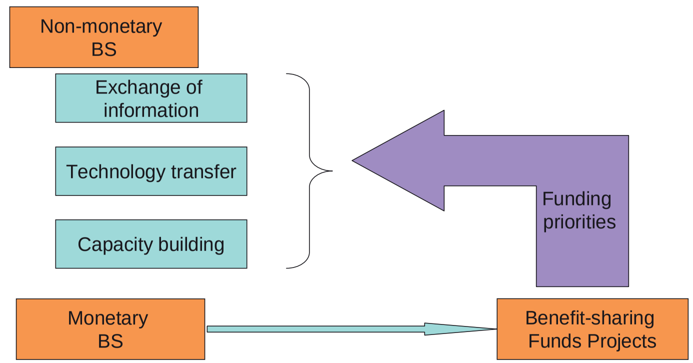
- **Hunger fell by 1/3 in Brazil btween 2000 and 2007**
- **Report: 'Hunger and poverty are concentrated in rural areas. Unlocking the potential of smallholder agriculture represents our single biggest opportunity to increase food production, boost food security and reduce vulnerability.'**

MLS, delivering three key inputs for breeding

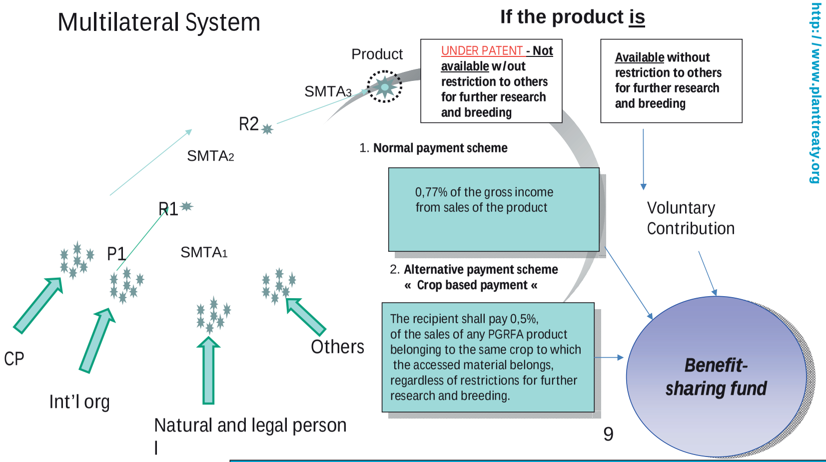


Food security, climate adaptation, rural viability…

Benefit-Sharing Mechanism under ITPGRFA



Monetary Benefit Sharing



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Benefit-sharing Fund

- Established by Contracting Parties to invest in high impact projects supporting smallholder farmers in developing countries (Article 18.3, 18.5, 19.3(f)).
- Clear focus on food security, adaptation of crops to climate change and conservation and sustainable use of agricultural biodiversity.
- Financial support from Spain, Italy, Norway and Switzerland to the Fund - 11 global projects funded under the first Call for Proposals.

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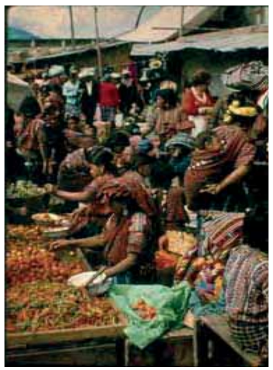
The International Treaty
ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

Benefit-sharing

- Because these genetic resources are pooled, there is no individual owner with whom individual contracts for access and benefit-sharing must be negotiated
- This means there are very low transaction costs, to the benefit of farmers, plant breeders and researchers, and ultimately of consumers
- It also means that benefits must be shared in a pooled, multilateral way



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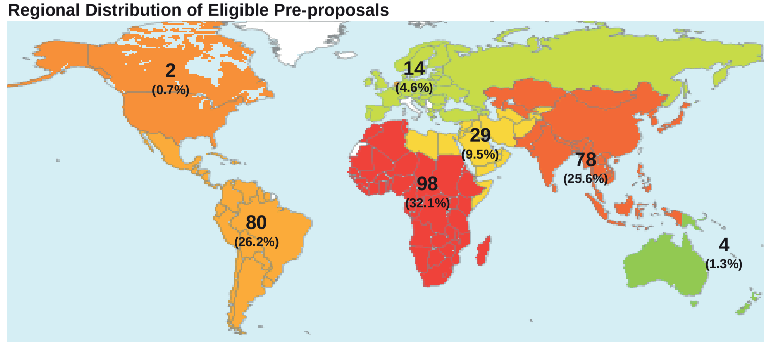
Benefit-sharing Fund: First Project Cycle

-The GB opened the Call for Proposals under the Benefit-sharing Fund for the biennial cycle of 2008-2009

- The Secretariat received hundreds of pre-proposals, representing all seven FAO regions

Regional Distribution of Eligible Pre-proposals



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Fund priorities

- Sustainable use of plant genetic resources
- On-farm management and conservation of plant genetic resources
- Information exchange, technology transfer and capacity building for the conservation and utilization of plant genetic resources for food and agriculture

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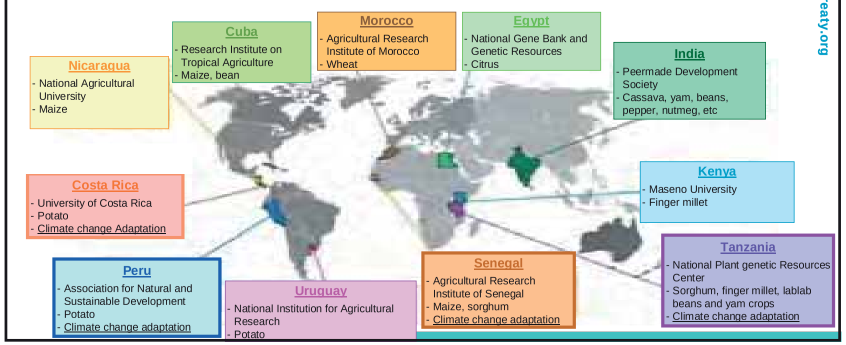
Benefit-sharing Fund: First Project Cycle

- 11 projects were approved by the Bureau of the GB
- The GB has set funding targets over the next five years to continue supporting high impact projects addressing global issues



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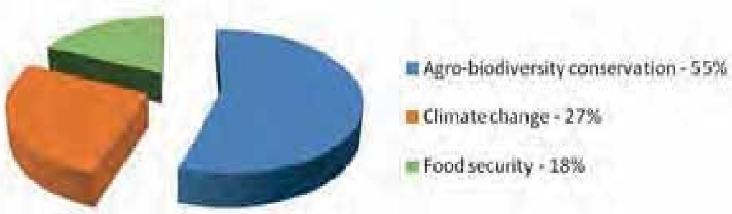
Benefit-sharing Fund: First Project Cycle

Challenge addressed in 11 approved projects



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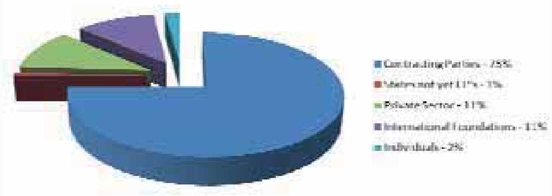
GB3 Strategic Plan to raise US$116 million



Tier	Annual investment level
Tier I	Up to $2.6 million
Tier II	Up to $870,000
Tier III	Up to $345,000

Year	2010 (15 months)	2011	2012	2013	2014
Cumulative	$10m	$27m	$50m	$80m	$116m

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Leadership investments since GB3

- Spain - US$2.2 million
- Italy - US$1.2 million
- Australia - US$870,000
- UNDP - US$10 million
- Norway committed % of seed sales annually
- Kenya recently confirmed its intention to support the initiative

Expert Advice

- The Bureau oversees the execution of the project cycle of the Benefit-sharing Fund during the biennium 2010/2011.
- The Bureau sought expert advice on the execution of the Benefit-sharing Fund's next project cycle
- Advice was provided by high-level experts: Dr. Geoffry Hawtin, Prof. Swaminathan, Dr. Roberto Acosta, Dr. David Hegwood, Dr. Bala Ravi Sekhara Pillai
- To have a more substantial impact, it is important that, fully consistent with the BSF priorities, the use of funds be highly focused thematically
- The thematic focus should be on the conservation and use of PGRFA to help ensure food security in the face of climate change

Information on the Call

- Deadline for submission of pre-proposals – last **8th September 2010**

•The expected funding available for the call is at least US$10 million

• Any governmental or non-governmental organization, including genebanks and research institutions, farmers and farmers' organizations and regional and international organizations, based in countries that are Contracting Parties.

Priorities of the call for proposal 2010

- Information Exchange
- Technology Transfer
- Capacity Building
- On-farm conservation and management of plant
- Genetic resources for food and agriculture;
- Participatory plant breeding and
- Distribution of appropriate seed and planting materials.

Information on the Call

- Eligible Contracting Parties are developing countries, according to the most recent World Bank's classification of economies

- Pre-proposals and full projects had to be submitted to the Secretary through the National Focal Points or the Permanent Representatives

Information on the Call

- Window 1

Development of strategic action plans

- Window 2

Immediate action projects

Window 1: Development of strategic action plans

The role of plant genetic resources in adapting to climate change must be addressed strategically, planning and structuring action plans and effective policy responses.

It is necessary to agree the priorities for a wide range of stakeholders.

The action plans should set priorities at different levels, including regional, sub-regional, eco-regional, etc.

Project Value: Maximum $ 400.000

Duration: 1 year

It covers all plant genetic resources for food and agriculture

Window 1: Development of strategic action plans

Focus on agro-ecological zones or eco-regions eg. dry-land marginal floodplains, areas of coastline, high mountain

Could concentrate on the basis of crops (cereals, legumes, vegetables)

Window 1: Development of strategic action plans

Should aim to identify needs for information exchange, technology transfer and capacity building

Should clarify how the proposed activity areas will help to assist farmers to adapt their crops to climate change.

Should be developed and implemented by national, regional, international, efficient networks, new partnerships or stakeholder groups.

Window 2
Immediate action projects

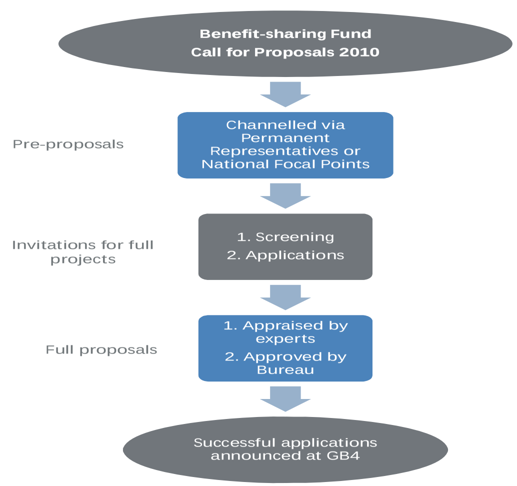
The proposals are expected to focus on plant genetic resources for food and agriculture in the Annex I of the Treaty

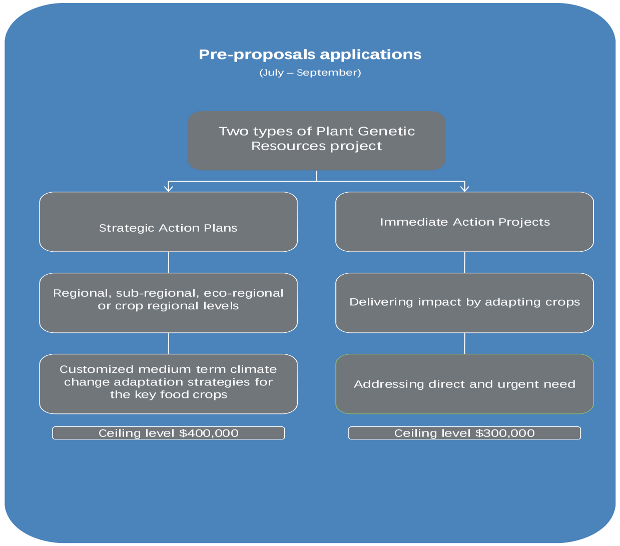
Value of Projects: not to exceed $ 300.000

Project duration: 2 years

Immediate impact projects or short term

Projects for the management and conservation on-farm, participatory plant breeding and distribution of seeds and planting material





http://www.planttreaty.org

Information on the Call for Proposals

- The Bureau, according to recommendations made by the Ad Hoc Advisory Committee, will screen the pre-proposals according to agreed eligibility criteria
- The Bureau will decide what applicants will be invited to submit full project proposals before **29 October 2010**
- Full project proposals should also be submitted to the Secretary through the National Focal Points or Permanent Representatives by **27 January 2011**
- Full projects will be appraised by a Panel of Experts nominated by the Contracting Parties
- The Bureau will approve projects to be funded
- Announcement of projects funded during GB4: **14-18 March 2011**

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Technology, Food Security and Sustainable Development – Transcription of Oral Presentation by **Mr. Christophe Bellmann, Programmes Director, International Centre for Trade and Sustainable Development (ICTSD), Geneva, Switzerland**

The objective of my presentation is to highlight some of the key policy issues related to intellectual property rights in the debate on food security and technology transfer. We need to make a distinction between different types of technology transfer and development mechanisms, particularly the private sector and the public research. Also, we need to distinguish between different types of agricultural systems, the market-oriented agriculture versus the small-holder types of agriculture. Finally, I shall try to put intellectual property rights in a broader context of development and technology needs of developing countries, looking also at the effects of climate change.

First, the challenge ahead: Food price spikes 2007-2008 and again 2010-2011 for some crops, not so much for rice, but more for wheat and others; the need to increase food production by 70% by 2050 in a world of resource scarcity – we know that the size of land per capita is going down; we have issues with water and climate change induced variations in temperature, in precipitations. The increased likelihood of extreme weather events will alter crop and animal productivity; it will completely change comparative advantages in agriculture and, ultimately, it will affect global trade flows.

Let me just give you an example: Here is some of the modeling that IFPRI has been doing. In this case we are looking at rice under the A2 scenario of the IPCC using a climate model developed by the US National Council for Atmospheric Research. It tries to understand the differentiated impact of climate change in different countries. If you look for example at West Africa, you see a lot of yellow and red. This means loss of productivity - in yellow between 5 and 25 per cent in red above 25 per cent If you look at India or South East Asia you see that we are in serious trouble. On top of that, food prices are likely to continue to increase. Especially as population and income grows surfaces' productivity and area under cultivation will also grow. This will be further accentuated by climate change.

This is also some of the modeling done by IFPRI looking at prices of different commodities such as beef, poultry, pork, rice, soybeans, wheat, maize. The first blue column is representing 2000 prices; the red one is representing prices in 2050 without climate change. So, we already see a considerable increase that is expected anyway because of population and income growth. When looking at the impact of two different climate change models both without carbon fertilization, the one developed by the US and the other one developed by the Commonwealth Secretariat, you see that in products such as wheat there will be an additional increase in prices by some 100 per cent, just because of climate change.

How is this going to affect different countries? It depends very much on how people are feeding themselves. There are basically two ways of insuring food security: you produce your own food, nationally you have stocks and domestic production, or you import. Depending on your trade exposure and your domestic productivity you might be more or less affected by climate change. Here, we are looking at these two variables for a number of countries: the horizontal axis represents the extent to which countries depend on food imports, as a share of total imports; the vertical axis represents the expected climate induced change in agricultural productivity by 2080. In red you have countries that are currently net food importing countries. So, a country such as Senegal which's agricultural imports account for more than 25 per cent of its total imports might, at the same time, be affected by a productivity decline of more than 50 per cent by 2080. Thus, Senegal would be doubly affected, firstly, because domestic production is going to be a challenge and, secondly, because the country will have to import much more food and will be affected by much higher food prices. India, for example, does not necessarily import a lot of food, but will be clearly affected by climate change. If you remember some of the previous modeling exercises, it can be expected that South Asia is probably going to double its imports of food in the coming years. So we have a major challenge here.

On top of that, we have price volatility that is increasing, has been increasing since 2006. Some argue that now food markets are increasingly linked with energy markets through fossil fuel prices related to fertilizers and different types of inputs. Yet, productivity in agriculture seems to be stagnating. Growth in agricultural yields has almost halved since 1990 according to OXFAM. All these factors point to one particular aspect which is the need for enhanced investment in research and development in agriculture.

Basically, human beings satisfy their nutrition needs in two different ways and this is very much related to the form of agriculture: One form of agriculture is a small-holder economy, a self-sufficient, subsistence type of agriculture. There are small economic units, typically family units, and there is very limited trade, maybe in some fertilizers. But by and large the populations are self-sufficient. Here the technology needs are more related to getting better seeds, livestock or feed, some food processing capabilities, some storage capability. They need access to credit to be able to invest in agriculture. The other form of agriculture is more the market economy type of agriculture where you produce for a market and you consume goods that you purchase on the market. Here the technology needs basically relate to the need to enhance production through seeds or inputs, how to bring your food to the market through transportation, storage facilities, issues of packaging, issues of how you can add value to what you produce, how you can integrate the global value chains. It is a completely different set of technology needs.

If you look at how technology has been developed and transferred, you also have two different models: The one is based on the public sector, on public research in agriculture and food processing, and seed and breeding research. Typically, in developing countries the CGIAR centers have played a major role in this public research. But, increasingly, a number of developing countries have their national research capabilities - EMBRAPA in Brazil but also in China, India and South Africa. I think some of the speakers who we are going to listen to will tell us more about this national research in the public sector.

With regard to the challenges and trends here, I think, firstly, that the public sector has played a major role during the Green Revolution. Some say that it has been the highest benefit from public expenditure ever achieved in the world. The problem is that public research remains under-developed, particularly in the least-developed countries and there is a general trend towards more research being done by the private sector.

Secondly, there is the private sector. We know that the seed industry has been playing a very critical role, both with traditional breeding and with biotechnology, in innovation and transfer of technology, particularly in middle-income countries. The problem is that this research rarely reaches the poorest. 95% of it is taking place in the North and the seed industry has become highly centralized and concentrated which might raise issues of competition. The second important characteristic of the private sector is the development of these large supermarket chains, the large scale food processing operations that are integrated vertically. This development, to be fair, has contributed quite substantially to improve the quality of food and has contributed to the transfer of technology, particularly in middle income countries, and to improved quality control. However, some say the emergence of this kind of oligopolies has also displaced farmers, it has affected the environment and the market structure.

With the objective of combining these dimensions, John Barton in 2005 has developed an analytic framework for us. Those two forms of technology transfers, those two forms of agriculture can be presented as four quadrants. In each of them you have specific policy issues and concerns related to intellectual property rights. I shall briefly consider the four of them and try to highlight the main policy issues.

In the first quadrant there is a market oriented agriculture and a private sector based transfer of technology. The first big question for governments is: "Do we adopt a UPOV style of IP policy or a minimum compliance policy with the TRIPS Agreement?" or "Do we go for a stronger biotechnology-oriented patent system?" The answer depends very much on a country's potential for developing a national seed industry. If there is a strong potential for developing a country's own national seed industry the government might want to go for the stronger types of IP-related incentives. It tends to be often linked to economic development; in the poorest countries you probably come to the conclusion that there is no great potential for having a strong national seed industry and you might want to go rather for a weaker type of protection.

The second element to be taken into account is biotechnology. Some countries have embraced biotechnology, have used it extensively. Others have been more reluctant, partly because they fear that it would make it more difficult for them to export some of their products to some parts of the world, including the European Union.

The third challenge is how to address concentration in the seed and biotech industry. Again, this depends very much on the level of private sector competition in a particular country. If that level is low you might want to make sure that your public sector varieties are still available on the market. You might need to focus, particularly in some of the middle-income developing countries, on developing a strong competition law that can balance your IP system. Of course, trade and micro-economics policies are important, looking at your tax regime, investment policies, your market access conditions, looking at trade distorting subsidies, particularly if you are export oriented.

The second quadrant is with a market oriented agriculture and a public sector research. Here, in theory, there should be limited needs for public means of transfer of technology. If you have an efficient market-based private sector agriculture, a role for the public sector research might be to maintain availability of some of the public sector varieties, where there is limited competition. In some countries where you have strong public sector research you might consider arrangements for patenting by public research establishments and licensing out public sector inventions to the private sector. A big challenge in this type of context is to ensure that your public research is adding value and is not doing what the private sector would be doing anyway. So, how do you focus your public research? Probably you will have to focus more on subsistence farming, maybe on some of the environmental challenges, it could be water use, it could be climate change. There is a whole debate on whether you should focus more on downstream adaptation of technologies that have been developed elsewhere, or whether you should move more upstream in research, including fundamental research on tropical agriculture, rather than just depending on research being done elsewhere and adapting it nationally.

The third quadrant is with small-holder agriculture and private sector research. Generally, private sector research tends to be irrelevant to subsistence farmers, simply because in most cases they are unable to purchase the products of that research. In this context, you might have very limited benefits from a UPOV style or even a regular patent type of protection. The protection system is not going to make any difference. It is not going to generate the incentives you are trying to achieve in the poorest countries. The seed law and plant breeders' rights are clearly the main challenge in this context. The 1991 Act of the UPOV convention allows saving of seed but not seed exchange, whereas this might be consistent with other *sui generis* systems under the TRIPS Agreement. For this type of situations, one might want to think also whether it would make sense to review UPOV 91 to take into account the concerns particularly of the small holder agriculture.

A fourth big issue is the potential for public/private licensing arrangements, where you are trying to bring the new technology to subsistence farmers. The private sector could do this at nearly the marginal cost of reproducing the seeds. That would help small farmers to enter slowly the agro-industrial sector. The risk for the private sector is very limited because you are dealing by definition with subsistence farmers who are not going to sell what they produce. This appeared to be the case, for example, with the Golden Rice experience where humanitarian licenses have been used. Thus, this type of partnerships could be interesting to be pursued.

Finally, in the fourth quadrant there is small-holder agriculture and public sector research. Here, the key policy issue is to define very clearly the research task. If you look at the experience of the Green Revolution, the idea was basically to introduce the dwarfing gene into wheat and rice which would allow more efficient use of fertilizers. What is the next big question to be answered, what is the next priority area of research; those matters have to be considered very carefully by the public sector. Then, the relation with the private sector – upstream versus downstream research: In this particular area there might be a challenge related to increasing patenting of research tools. This might cause researchers to be held liable for patent infringement. Whether this is a real concern, particularly in the subsistence sector, needs to be further analyzed. I am not sure that there is a lot of empirical evidence. In theory you could think that this might be a problem. But since you are dealing with subsistence farmers, is this really something that the private sector needs to be concerned about? Anyway, this might be an area of concern. However, there are several ways to deal with it. Governments, when developing their patent law, should maintain very high standards of non-obviousness, inventive steps, and industrial applicability, to make sure that there are no patents granted which are very broad and might act as a barrier for further research. Of course, research exemptions in patent systems exist in most – if not all – developed countries. And, again, the use of specific licenses, such as humanitarian licenses is always possible.

These are the main policy issues. Now we need to put this into a broader context. When we talk about technology transfer and food security, IPR is just one part of the story. There are many other constraints, many other problems that one has to overcome. The fact that you have differences in agro-ecological conditions means you cannot just take an invention and apply it as such in another country. In many cases the problem is more related to water management and irrigation, to the use of inputs such as fertilizers. How do you deal with the marketing and the supply chain? Information is of particular importance, especially in the context of climate change, weather information. What is going to happen? What about access to credit, insurance schemes? All these are elements that might be even more important than intellectual property rights. With regard to climate change, attempts have been made to identify technology needs for climate change mitigation or adaptation in agriculture. The UNFCCC Secretariat has compiled technology needs assessments for agriculture in 70 developing countries. The type of technologies that have been identified for, first, mitigation and, second, adaptation of agriculture, comprise crop varieties with improved resistance against drought, heat, pests and diseases, which is related to intellectual property rights. But in many of other cases you are basically dealing with agricultural practices. And how you improve those practices might even be more important in climate change adaptation or mitigation than intellectual property rights.

Technology, Food Security and Sustainable Development

By Christophe Bellman, ICTSD

Presentation at the WIPO Seminar on

"How the Private and Public Sectors Use IP to Enhance Agricultural Productivity"

Geneva, 14 June 2011

Objectives

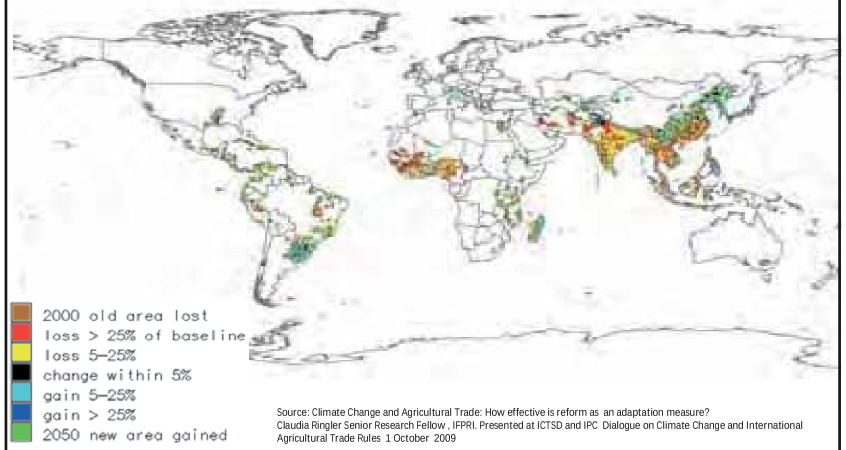
- Highlight the key policy issues related to IPRs in the debate on food security, technology transfer and development and sustainable development
- Making a distinction between different technology transfer and development mechanisms (private vs public) and agricultural systems (market-based vs. small-holder)
- Put IPRs in the broader context of development and technology needs in developing countries

The food security challenges ahead

- Food price spikes in 2007-2008 and 2010-2011 have reversed recent progress in reducing hunger
- 70% increase in food production will be needed to feed 9 billion people by 2050 in a world of increased resource scarcity (land, water)
- Climate change induced variations in temperature, precipitation and the increased likelihood of extreme weather events, will alter crop and animal productivity, and ultimately global trade flows
- Long term increase in food prices as population and income growth surpass productivity and area growth further accentuated by the effect of climate change.
- Short term increased food price volatility & link with energy market.
- Yet, productivity is stagnating and growth in agricultural yield has almost halved since 1990

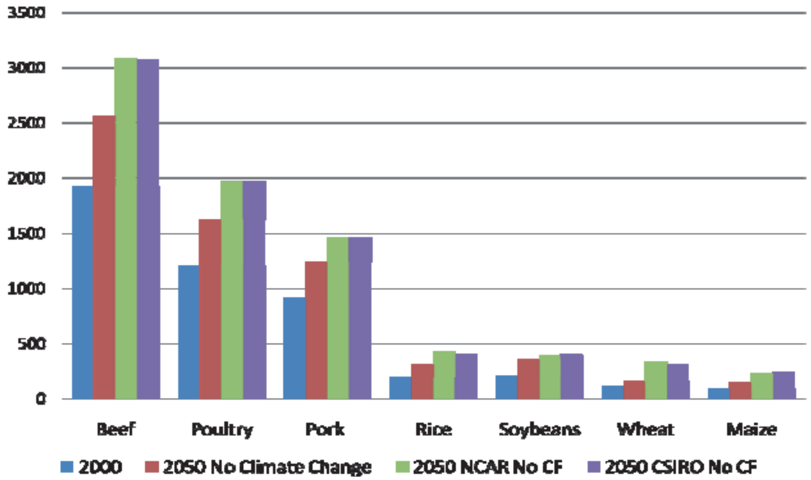
Repeated calls for investment and R&D in agriculture

Climate induced percentage change in yields in 2050 : Irrigated Rice (NCAR A2)



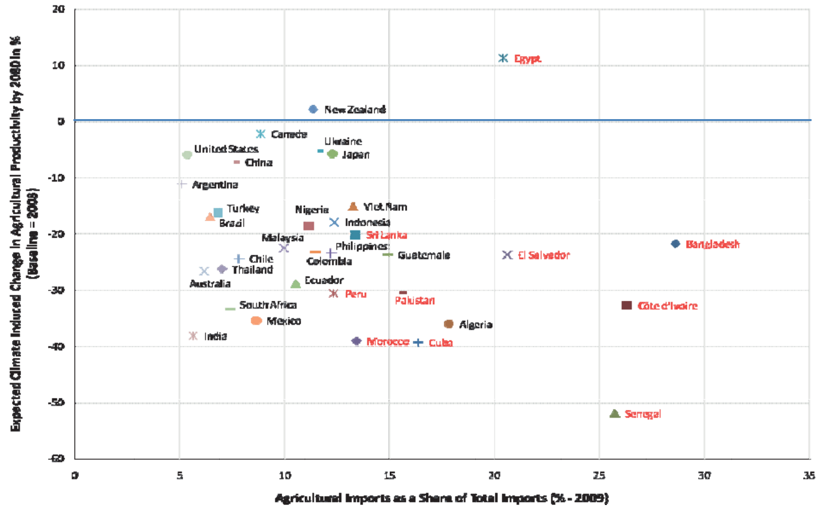
Source: Climate Change and Agricultural Trade: How effective is reform as an adaptation measure? Claudia Ringler Senior Research Fellow , IFPRI. Presented at ICTSD and IPC Dialogue on Climate Change and International Agricultural Trade Rules 1 October 2009

World Prices of Selected Crops and Livestock Products under Different Climate Scenarios (constant 2000 US$/metric ton)



Source: The Role of International Trade in Climate Change Adaptation, by Gerald Nelson, Amanda Palazzo, Claudia Ringler, Mark Rosegrant, Timothy Sulser, and Miroslav Batka, Issue Brief No. 4, December 2009.

Agricultural Imports as Share of Total Imports and Expected Changes in Agricultural Productivity



Humans satisfy their nutrition needs in two fundamentally different ways

Form of Agriculture	Technology Needs
Small-holder economy: • Self-sufficient subsistence • Small economic unit (family) • Limited trade (fertilizers, seeds)	• Better seeds/livestock/feed • Food processing capabilities • Storage procedure • Access to credit
Market economy: •Production of food for a market •Consumption of goods procured on the market	• Enhance production (through seeds or inputs) • Transportation/storage facilities • Packaging • Value added processing • Integration in global value chains

Two main mechanism of supporting the development and transfer of technology

Form of technology transfer and development	Challenges and trends
Public sector: Agriculture, food processing, seed and breeding research E.g. CGIAR, but also national research (Brazil, China, India, Kenya)	• Major role during green revolution • Highest benefit from public expenditure • Public research remains under-developed in Africa • Trend towards more research being done in the private sector
Private sector: Since development of genetic engineering, seed industry plays critical role (traditional breeding + biotech) in both innovation and TOT in middle income countries	• Rarely reaches to poorest • 95% taking place in the North • Seed industry has become highly centralized and concentrated.
Development of large supermarket chains, large-scale food processing and vertically integrated production and operations	• higher quality of food and ToT to producers – e.g. quality control - but may displace farmers and affect the environment and market structure (oligopolies)

KEY POLICY ISSUES

		Form of Technology Transfer	
		Private	Public
Form of agriculture	Market	1 Private sector, market agriculture quadrant	2 Public sector, market agriculture quadrant
	Small-holder	3 Private sector, small-holder quadrant	4 Public sector, small-holder quadrant

Quadrant 1. Market agriculture and private sector: key policy issues

- UPOV style system in minimum compliance with TRIPS vs. stronger biotechnology-oriented patent system?
  - Potential for national seed industry/technology adaptation. Often linked to level of economic development
  - Attitude towards biotechnology
- Addressing challenge of concentration in the seed/biotech industry while encouraging ToT
  - Level of private sector competition and need for making public sector varieties available
  - Need for adequate competition law in middle income DC
- Trade and macroeconomic policies
  - Tax regime, investment policies, market access conditions

Quadrant 2. Market agriculture and public sector: key policy issues

- Limited need for public means of ToT in efficient market-based agriculture with strong private sector.
- Maintain availability of public sector varieties where there is limited competition
- In middle income countries consider arrangement for patenting by public research establishment and licensing out public sector invention to private sector
- Need for focused research policy (both int'l and national)
  - Subsistence farmer, climate change, water use
  - Move from downstream adaptation of technologies developed by private sector to longer term upstream research
  - Enhanced coordination at int'l level and closer cooperation with global private sector, developing new partnerships

Quadrant 3. Small-holder agriculture and private sector: key policy issues

- Private sector research tends to be irrelevant to subsistence farmers unable to purchase research products
- Limited benefit from UPOV-style or regular patent protection for agriculture in poorest nations
- Seed law and plant breeders' right as a main challenge
  - UPOV 91 allows seed saving but not seed exchange, whereas this might be consistent with a *sui generis* system under TRIPS
- Potential for public-private licensing arrangements (humanitarian licenses, see golden rice experience)
  - Bring new tech to subsistence farmers at near the marginal cost of reproducing seeds.
  - Help small farmers enter the agro-industrial sector

Quadrant 4. Small-holder agriculture and public sector: key policy issues

- Need to define the right research tasks
  - e.g. dwarfing gene in wheat and rice for efficient fertilizer use during green revolution
- Relation with private sector:
  - upstream vs downstream research ?
  - attitude towards biotechnology
- Challenge related to increasing patenting of "research tools" possibly causing researchers to be held liable for patent infringement.
  - How real is this concern in subsistence sector (?)
  - Maintain high non-obviousness/inventive step, application oriented utility/industrial applicability standard
  - Research exemption in patent system
  - Specific license

Technology transfer and development beyond IPRs

- Differences in agro-ecological conditions
- Water management and irrigation
- Other production inputs: fertilizers, pesticides
- Marketing & supply chain (transport, storage)
- Information
- Access to credit
- Insurance

Technology needs assessment in agriculture to address climate change

Examples of Technology Needs for Mitigation in Agriculture	Examples of Technology Needs for Adaptation in Agriculture
• Crop waste gasification • Improved cultivation methods • Production and management of soil nutrients • Rational application of fertilizer • Drip irrigation • Biodigesters (manure management using digesters) • Better land management • Solar (photovoltaic) and wind water pumps • Solar energy for processing of agricultural products • Modification of livestock feed	• Tolerant/resistant crop varieties (to drought/heat, salt, insects/pests, improved seeds) • Efficient water utilization and improved irrigation systems (drip irrigation, creation of networks of reservoirs and water resource management) • Low-density planting, adjustment of sowing dates and crop rotation • Land management • Improved drainage • Integrated pest management • Sustainable grazing and herd management • Heat-tolerant livestock breeds • Networks of early warning systems

Discussion

Transcription of Q&A Dr. Shakeel Bhatti and Mr. Christophe Bellmann

Q. – Mr. Baazia Riad (Consultant) to S. Bhatti: The Fund is part of FAO, it is administered by FAO. You said also there are others who have contributed to this Fund, such as IFAD. IFAD is also a fund, a small international organization based also in Rome. A second question: Whether the Fund takes into account the circumstances of access or is just a benefit sharing mechanism, and what do you think if we will have in the future a second fund with the same objective administered by another organization.

A. – S. Bhatti: I wanted to mention, actually, that the Benefit-Sharing Fund itself is administered through a FAO trust fund. So, from a pure accounting point of view the trust account, to put it more precisely, is located in FAO because the Treaty and its Secretariat are hosted in FAO. So, from that point of view, it is an FAO trust account.

At the same time, there are two additional factors to qualify that: the Fund has a mechanism which is under the direct control of the Governing Body of the Treaty, and the Treaty membership is slightly different from the FAO membership. So, the funding decisions on the projects that are funded by the Fund are taken by the Governing Body with its own membership.

The second qualification is that some of the commitments to supporting the Benefit-Sharing Fund of the Treaty have been made in form of commitments that will not, technically speaking, flow through the trust account. So, for example, UNDP has committed 10 million Dollars to work on the projects of the Fund, but it will not be transferring those resources directly through this particular account. Yet, it is committing to an investment into the Fund.

The third qualification relates to your second question about IFAD. IFAD, indeed, is the International Fund for Agriculture Development and has an entirely different scale. Because they see the Benefit-Sharing Fund of the Treaty as a unique instrument that is quite uniquely linked and tied with the global gene pool like no other fund, and because it has this network of outreach to the ground level, to the field, through the national focal points of the Contracting Parties so that it can reach out directly for strong impact on farmers and farmers' communities in supporting them to adapt to climate change – because of those reasons IFAD has actually decided to invest these 1.5 million Dollars and is now additionally looking for co-financing of an additional 1.5 million. So, both are funds but they do different things, in summary.

Your third question – if I understood correctly – was whether the Fund finances only the benefit sharing side and not the access side? In fact, I would like to stress one thing, which is that the access itself is a major benefit. The Treaty creates facilitated access which means free of charges access to the resources in the gene pool for food security, so in that sense facilitated access is in itself a benefit. That is one aspect. The second is that in some cases the projects that are funded include or involve utilization of the facilitated access under the Treaty. So, what I am trying to say is that facilitated access and benefit sharing are not two opposite things. They are distinct, but they are, to a certain extend, both benefits. The final part on this last question was that the benefit sharing projects, like what you saw there on the slides, those potato varieties being now identified, characterized by the researchers, will all be available within the Multilateral System. They will be included in the gene pool and will consequently be available through facilitated access. That includes also the information generated: scientific characterization, evaluation, documentation, and passport data of these varieties and this germplasm, will all be available under the terms and conditions of the Multilateral System.

Q. – Dr. Shadrack R. Moephuli (South Africa) to Mr. Christophe Bellmann: A question related to your analysis of small holder agriculture and the private sector, since that concerns key policy issues. You are mentioning that one may need to re-examine UPOV 91; to what extend would this also mean a need to re-examine UPOV 78 for a greater impact on small holder agriculture.

A. – C. Bellmann: Reference to UPOV 91 was essentially made in order to deal with the issue of exchange of seeds. That might be relevant for the small holder agriculture. It is something that you could secure under a TRIPS *sui generis* system. I understand that under UPOV 78 that is not an issue, but under UPOV 91 it might be an issue and something that governments might want to consider. Other issues that need to be addressed – your question is whether under UPOV 78 there are other issues that might need to be addressed or whether you’re fine with that Act of the UPOV Convention. The biggest question is whether you want to go for a UPOV-style of protection or more for a patent oriented system. I tend to think that for the small holders maybe the UPOV system or a kind of minimum TRIPS compliance would be more appropriate.

Q. – Ms. Catherine Saez (IP Watch): An increase by 70% of food production to feed 9 billion people by 2050 – are those estimates which everybody agrees on? What are the sources of the numbers?

A. – Mr. Rolf Jördens (WIPO): I think that those are results of a recent assessment by FAO.

A. – C. Bellmann: With regard to the growth of the world population those estimates come from the UN; how real these figures are? You don’t know. You can look at different types of scenarios, very difficult to say which scenario is going to happen. The 9 billion is the only viable scenario. The 70% increase in food - some people were saying 50% increase, but I understand that the 70% is related to the fact that still a lot of the production gets lost, so it has to be more than 50% increase. So, that is why people now are coming with this figure of 70% increase in food production.

Q. – R. Jördens: A question on the classification of small holder agriculture and then the market-oriented agriculture: there are of course intermediate phases and those who are small holders or even subsistence farmers today, wish probably to produce for the market tomorrow. There is a permanent evolution, subsistence farmers try to become market oriented producers because that is probably the only way for them to get out of poverty and misery.

A. – C. Bellmann: You are absolutely right, there are many steps between those two categories, and, of course, I tend to think that most subsistence farmers would not have a reasonable objective in just staying what they are.

Q. – Dr. Stephen Mwkiya Mbithi (Kenya): I think that we have just to be cautious; it is not true that “small holders” means “subsistence farming”. There are good examples of small holders who are also participating in the market economy.

A. – C. Bellmann: You are absolutely right. The point is self-sufficiency: people are consuming the food they produce themselves as opposed to purchasing food on the market. I fully agree with you that you have small producers who are perfectly integrated in the market, and the vegetable producers in Kenya are a good example.

Q. – Mr. Peter Button (UPOV): You mentioned the UPOV Convention and, of course, we will be talking a little later on today about UPOV. However, perhaps I can already recall that there are many developing countries that are members of UPOV. We have had speakers from South Africa and Kenya; the success of plant variety protection in those countries indicates that there are no fundamental issues with the way the UPOV Convention works in relation to the exchange of seeds. It is certainly important to reflect on the experiences of developing countries and to consider their positive experiences with plant variety protection and membership of UPOV. The UPOV system is certainly well suited for developing countries.

A. – C. Bellmann: I don't think I said UPOV is not useful for developing countries. The point here is that you need to look at the smaller holdings and the market oriented agriculture. Under each and every condition you have different situations and that requires specific responses from the Governments. I think it is important to have this level of disaggregation and not to debate on whether UPOV is good or bad. The world is more complex, and only when we try to dig a little bit deeper and look at this diversity and heterogeneity of situations and particular needs, then we can respond more effectively. I don't think the debate should be against or for UPOV. Is it good, is it bad, is it the 91 Act, is it the 78 Act of the UPOV Convention? This is not leading anywhere. We need to look at what is the problem we are trying to address, what are the technology needs, what is the situation of the producers, the farmers, and then develop appropriate responses.

Q. – Mr. Oswaldo Reques (Permanent Mission of Venezuela): I agree with the speaker's position. I don't think that all small holders are corporate within a future market vision. This has to do with a way of life and a way of subsistence which is related to traditional knowledge. It is one way of understanding life for many millions of years. Perhaps that is why it is so difficult for us to accept that here at WIPO the problem of traditional knowledge is simply considered a market and intellectual property based problem. However, it is linked to forms of life that have remained as such for many millions of years. Thus, I believe that the issue of small holders is not always linked to a market. That is why I was quite struck by the attempt to put everyone in the same boat. These are two very separate visions: one vision is based on the market dealing with intellectual property and another vision is linked to subsistence and a particular way of life.

R. Jördens: It is a question addressed to you, Mr. Bellmann, whether those are really two very different forms of life. That was, I think, your remark. You said subsistence farming is very different, has nothing to do with market-oriented production, it is a traditional form of life and, perhaps, people, families who live that way wish to live like that forever; it is certainly the case for some regions in developing countries, for some peoples.

A. – C. Bellmann: Absolutely, that can be the case. There is a very strong cultural dimension that has to be taken into account; it is not just about the market. It is absolutely essential to understand how those small farming communities function, what their aspirations are. We know that in many cases, for example investing in agriculture can be quite a challenge in some of the small holders' or self-sufficient farming communities. Because the moment they have additional resources they will not necessarily invest in production but they will probably send their kids to school, and make sure they have a better life. In other cases you have very strong cultural identities and traditional knowledge is associated with agricultural production. Thus, it is very difficult to categorize and generalize in this area.

R. Jördens: It is very important to offer a choice, not to impose particular models but to leave it to the people concerned to make their choice.

Which Technology Do African Farmers Need? – Transcription of Oral Presentation by **Dr. Stephen Mbithi Mwikya, Chief Executive Officer, Fresh Produce Exporters Association (FPEAK), Nairobi, Kenya**

I am a farmer and I represent farmers. I am going to speak about intellectual property rights and food security from that perspective. In Kenya we have a vibrant horticultural sector - fruits, vegetables and flowers. It is largely small holder farming and that is what I represent. Furthermore, I represent also the Horticultural Council for Africa. That is an association of 13 private sector organizations from 11 countries, comprising for example pineapple producers from Ghana, flower and vegetable producers from Ethiopia, bean producers from Egypt and farmers in Tanzania, Uganda, Ruanda, Malawi, Zambia, Zimbabwe and South Africa. We work together with the objective to facilitate trade with the products concerned. So, I shall talk about agriculture, but more from the point of view of a fresh product farmer, a horticultural producer.

Let me start with an introduction to horticulture in Africa: it is a fast growing sector. In some countries it is growing by 14 per cent in terms of value per year. A huge part of the production is for domestic consumption, difficult to quantify since we are speaking about fresh produce. Domestic consumption sometimes amounts to 95 per cent in terms of volume and 65 per cent in terms of value of the total production. Export is always the smaller part. However, for two countries, South Africa and Kenya, the value of trade in fresh produce exceeds 1 billion US Dollars per year. For South Africa that trade concerns essentially fruits and, to a lesser extend, vegetables and flowers. In Kenya it is 50 per cent fruits and vegetables and 50 per cent flowers. Of course, what matters for export is high value and low volume. You would not export cabbages by air from Kenya to Europe. However, the situation is different, for example, for green beans and flowers. For Kenya, revenue from horticultural exports by 1 billion US Dollars is a considerable economic factor. It exceeds the income from tourism, tea and coffee exports. That is just exports; the value of the domestic market, of course difficult to assess, is estimated at another 2 billion US Dollars. Those are clearly impressive indicators of the economic relevance of the sector, at least for an African country. It is important to note, in this context, that post harvest losses are estimated at 30 per cent of volume. Improvements in that respect, obviously, would have a major impact on food security.

In Kenya, horticulture or fresh produce provides employment for about 4.4 million people, directly and indirectly. Those comprise growers and farm workers, people involved in the value chain – transporting, merchandizing, processing. That amounts to 11 per cent of the working population. Those figures may give you an idea of the social relevance of the sector for Kenya. Fruit and vegetable growing is essentially a matter for small holders. They contribute 70 per cent to the overall production. Those farmers have one or two acres. Actually, in Kenya at the moment, the largest exporting companies which provide the world market with fresh horticultural produce heavily depend on small holders. There is a strong integration: regardless whether you are a small scale or a large scale exporter, the basis of your business is small scale horticultural production. Those one or two acres farmers cumulatively in the last two years have had average earnings of about 350 million US Dollars per year (?). They are semi-schooled farmers, some of them with limited formal school education. But they actually know very well how to grow vegetables to the standards required in Europe, the most demanding market. The basis of their participation in that chain from production to the market is their ability to meet international standards of food safety in the first instance and other environmental and social standards. Of course, uniformity and quality standards are a key to market success. They depend essentially on the proper choice of the plant varieties to be grown.

What is the food security dimension of horticultural production in Kenya? The first reality is that land holdings in Africa and in Kenya especially are fastly shrinking. At the moment the average size may be about 2.5 acres of land per household in Kenya. In areas with higher agro-climatic potential the holdings tend to be even smaller, perhaps around 1 acre. That is the case in many parts of Africa. In some counties such as Ruanda it is even worse. That is what needs to be noted in the first place: there is a squeeze on land.

The second reality is that farming continues to be by far the main source of livelihood. It is not an option for most families in Africa to easily diversify their sources of livelihood. Except in those few countries where, for example, mining is significant, in the vast majority of situations land is the basis of income. Certainly, other sectors such as manufacturing, services and high tech activities are starting to grow but it will take considerable time until those sectors will absorb a larger part of the work force.

With those two realities you have to respond to the basic needs: one is food – food security, the other one is medical care – medicine and medical treatment and the third one is school fees – education. Farmers with little land as the only basis of income and a family to care for tend to react very rational. They will go for high value agriculture with the objective to maximize economic return per unit of area. We see that increasingly in Africa. That is the main reason for growth of horticulture in Africa. There is no particular need of promotion of horticulture. It is just obvious to the farmer that half an acre of tomatoes feeds his family and the surplus money pays for medical care and for the school fees of his children much better than half an acre of cassava. If, however, a farmer has 100 acres the ratio between land and available work force might be very different and, therefore, the economically appropriate production pattern might also be different. That farmer might wish to make the best use of the limited work force of his family and might go for staple crops which are less labor intensive to grow such as maize and cassava. Thus, given the small size of holdings in Africa there is a need to maximize the revenue per unit of land, and that means horticulture – fruits, vegetables and also flowers. Even some very small scale farmers in Kenya are producing what we call summer flowers, less demanding flowers which can be grown in the open field.

The real issue with food security in Africa and in Kenya specifically - and I am saying that as a farmer - is not production, it is the market. Farmers have suffered far too long because it does not pay to be a farmer. Therefore, they tend to neglect their farm because it does not solve their basic needs. It needs to be food security, not food self sufficiency. Small scale farming can work very well if it is market oriented, regardless whether it is the domestic or the export market. What matters is food in the pocket of the consumer, not in the granary. We have hunger in Africa because the markets do not function, farming does not pay. If the markets were functioning properly farmers would respond rapidly.

What means intellectual property in this context? Firstly, to produce for a demanding market – and 82 per cent of our horticultural production for export is for the EU market – you need to be able to comply with high standards and to offer uniform products. For example, beans from Kenya with a particular texture and taste and other quality parameters are uniform, very predictable. That is only achievable through superior varieties which need to be bred by somebody. That brings us to intellectual property rights. We have 150,000 small scale farmers who are entirely dedicated to export horticulture in Kenya. You can multiply that figure by ten to get the total number of farmers who entirely depend on export horticulture (previously, I mentioned 4.5 million people in total working directly or indirectly in the entire horticultural sector). Secondly, in order to be competitive as a small scale farmer you have to be very productive, you need to lower the cost of production. If you have a variety that does not produce optimally you will be struggling to make the margins because commodity markets for fresh fruit use are so tight that the margins are very narrow. It punishes you to have an inefficient production system. That may include, in the future, genetically modified varieties that may be doing quite well. Thirdly, in fresh fruit production you need to be very quick at adapting to new technologies - a new flower, color or a new bean variety that the consumers prefer.

Those factors prompt the horticultural industry in Kenya to be huge consumers of IPR. There is a lot of research going on in Kenya producing a lot of varieties for horticulture. But many of them have been more for the domestic and regional markets. For leafy vegetables excellent research has been done especially by the public sector, some also by the private sector. But for export there is certainly a considerable dependence on imported varieties, seeds or cuttings. What are the issues? The cost issue, the royalties' issue, is the first. The other one is the relationship between growers and breeders. On average the royalties are about two to five per cent (of what?) depending on the variety or type of crop. Just take flowers which are largely subject to IPR. Therefore, the royalties are known and the figures are easy to calculate. The royalties amount to between 10 and 20 million US Dollars per year. It is certainly necessary to remunerate the breeder for his investment and work. But, frankly, if that money was invested into varietal research in Kenya a lot could be done – I listened to the figures mentioned earlier by Dr. Shakeel Bhatti, he spoke of some 10 million Dollars to be disbursed this year under the Benefit Sharing Fund of the International Treaty. That corresponds to the royalties we have to pay every year just for one commodity. Indeed, the matter of royalties is under serious discussion between the industry and the breeders. Frankly, the business relationship between breeders and growers is poor. It is just what the conventions and agreements stipulate. It is important to have a mechanism that recognizes that the breeder is a major investor in what is being grown. But also the producer has spent huge sums of money even before starting production. Breeders and growers need each other. Such a mechanism is lacking in the conventions and agreements which are under discussion at WIPO and that should be addressed. The principal stakeholders here are the people who have everything to loose and they are two groups: the producers and the breeders. Because of the lack of an appropriate mechanism there are now a few legal cases confronting breeders and producers.

What is the way forward? IPR in developing countries for small holder farmers are extremely important. It is most important to understand that small holder farmers are able to integrate in the value chain to any market in the world. They are successfully doing that. For them to be competitive IPR is an important tool. They need technologies and varieties that come through IPR. Good IPR mechanisms promote innovation. We need somebody to invest in that kind of knowledge and that, of course, stimulates technology transfer. In a country like Kenya which has signed up to IP conventions it was with a view to promote investment by breeders through protection of their rights. The horticultural sector appreciates that; it is good for the farmer; it is good for the breeder. We are increasingly seeing that IPR is becoming a very important tool for market access. Increasingly, we are seeing that as soon as a new variety is developed, the markets are actually demanding that variety. However, we need a mechanism for insuring fair play, which recognizes breeders and growers as key players.

IPR and Food Security

a Perspective from Developing Countries Farmers

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WIPO workshop, Geneva 14 June 2011

Horticulture- a short intro

- ..a rapidly growing high value agriculture in Africa: Morocco, Egypt, Ghana, Kenya, Ethiopia, South Africa, Tanzania, Uganda…
  – Fruits, vegetable and flowers
- Kenya and South Africa – at least 1 billion USD annual exports
  – And much more in domestic and regional trade
  – Rapidly growing…in Kenya about 14% per annum

Kenya hort at a glance

- 4.5 million people involved, direct and indirect (11% of kenya population)
- Domestic and export:
  – By volume: 95% domestic/regional trade, 5% export
  – By value: domestic 65%, export 35%
  – Exports – 1 billion US$ (50-50 flowers and fruits/veg
  – Fruits Veg for exports – 70% produced by smallholders (about 350 mil US$)
  – Basis of smallholder participation on the value chain:
    - Capacity to meet international standards, and uniformity partly created by IPR

Food Security Dimension

- Reality 1:
  – Land sizes are shrinking in africa, especially in areas with higher water availability
    - Average land-holding in Kenya is 2.5acres, and down to 1 acre in high potential areas
- Reality 2:
  – Farming is still the main source of livelihood in many developing countries
    - Jobs from industrialization or services are limited, agric is still the economic basis (except in a few mining countries)
    - Food, medical care and school fees – the three key costs of rural people
- Reality 1 + Reality 2 = High value agriculture
  – For food security farmers need to maximize on revenue per unit area
    - A case of tomatoes vs staple such as maize or cassava to a farmer with only 1 acre or land
    - Food security not Food self sufficiency. – Food in the pocket, not in the granary
- Small-scale farmers are VERY rational. Markets must work, for food production to be a food security tool

What's IPR about this?

- To produce for a demanding market, a uniform and quality product is necessary
  - e.g. Kenya green beans – uniform texture, predictable taste, from 150,000 farmers
    - Uniform seeds
- For competitiveness – productivity is key.
  - Superior breeds. No GM as yet
- Quick adaptation to new varieties, as market tastes change
  - Eg flower industry, especially roses

Experience with IPR so far- kenya Hort

- Enhanced Capacity to access markets
  - And improvement in productivity
- Significant domestic varieties development
  - Local and regional markets
  - Over- dependence on import varieties for export veges and flowers
- Huge royalties payments
  - About 2-5% of value of produce
    - In Kenya – 10 -20 million USD annually from flowers only,
    - Enough to support vibrant breeding research in Kenya, now supporting research in developed countries
  - Poor business partnership between breeders, propagators and farmers/producers.
    - Breeders have upper hand,
    - No or minimal risk-sharing mechanism
    - Breeder- grower tensions: Kenya, Ethiopia...etc
    - Ethical issues – both breeders and farmers

Way Forward -

- IPR is an important tool in producers in developing countries
  - For food security
    - IPR promotes innovation, and tech transfer to developing countries
    - For Market Access
- Needed:
  - A mechanism for ensuring fair play between producers and breeders
    - Producers are KEY stakeholders in IPR, just like breeders (both have a lot to lose if the mechanism doesn't work)
    - Formal producer voice at UPOV?
    - Careful limitation of what is IPR?

Thank-You

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WIPO SEMINAR: How the Private and Public Sectors Use Intellectual Property to Enhance Agricultural Productivity

ARC • LNR

Excellence in Research and Development

AGRICULTURAL RESEARCH ROLE IN ENHANCING AGRICULTURAL PRODUCTIVITY IN SOUTH AFRICA

14 June 2011

Delegate: Shadrack R. Moephuli
President and CEO: Agricultural Research Council

1. INTRODUCTION

In the last 30 to 50 years the global population has increased from 1 billion to the current estimate of 7.0 billion with a projected growth estimated at 9 to 12 billion by 2050. Meanwhile in the last 50 years agricultural production and the supply of food commodities outpaced population growth and market demand. Such unprecedented increases in agricultural production and productivity, called the Green Revolution, were attributed to long term investments in public agricultural research and development. Research and development efforts resulted in innovation, which in turn produced a range of intellectual assets in the form of significant increases in crop and livestock improvements as well as new technologies that revolutionized farming practices. The Green Revolution enabled the world, particularly in Asian countries, to stave off the Malthusian predictions.

Rapid growth in the global population and the continued rise in food prices have placed the agricultural sector in a crisis in which nearly 950 million people now suffer from chronic hunger. Overall, increased food prices particularly in developing countries where populations spend a larger proportional share of income on basic food commodities. Reasons for this crisis include climatic factors (such as drought for example affecting wheat production in Australia), the rising cost of inputs especially oil and oil-based products, as well as a switch of land use from production of food to biofuels. The share of vegetable oil consumption used for biodiesel production is expected to increase from 9% in 2006/08 to 20% in 2018.

Another important driver impacting agricultural supply is that of climate change and vanishing water resources. Global warming is argued to seriously alter crop yields and can irreversibly damage the natural resource base on which agriculture depends. Some negative impacts are already visible in many parts of the world. Water scarcity and the timing of water availability will increasingly constrain production. The impacts of climate change will add significantly to the development challenges of ensuring food security and poverty reduction. Without adaptation, climate change will leave half of the world’s population facing serious food shortages.

The impacts of population growth in many developing nations, while accelerating the global impact of climate change, could present opportunities for investment in agricultural research that would spur innovative solutions. Whilst overall intake in Europe and the USA is unlikely to increase much, demand from developing countries, largely the result of population growth, urbanization, and rapid economic development in East and South-East Asia in particular will increase by 5% per annum for years to come. Milk consumption has increased seven fold over the past decade and China is consuming twice as much vegetable oil and basic foods. Many niche markets have developed and people are drinking four times as much wine as 10 years ago. Similar projections could be made for the rapidly growing African population.

Consequences of this increased agricultural demand stretch from one end of the food chain to the other. Although food prices have come down from the record peak of early 2008, they remain high in many poor countries. Average crop prices are projected to be 10 – 20 % higher in real terms for the next 10 years compared with the average for the period 1997-2006. Prices for vegetable oils are expected to be more than 30% higher. Average dairy prices in real terms are likely to be slightly higher over the period 2009-18 relative to 1997-2006, driven up by rising energy and vegetable oil prices.

According to recent Food and Agricultural Organisation (FAO) research using longer term population and income projections, global food production needs to increase more than 40% by 2030 and 70% by 2050, compared to average 2005-07 levels. Expanding supply will however be difficult as the amount of arable land does in reality not grow by even 1% per year. Existing land is becoming more valuable, and hence the increasing demand will have to be met chiefly by increased production from agricultural lands already in use, posing a strong case for investment in agricultural research and development for innovation. All efforts should therefore be made to improve agricultural productivity to ensure sustainable food availability, affordability and development.

Multinationals in the agricultural industry reported growth of roughly 10% last year, and the industry is expected to grow by more than 12% this year, the global economy notwithstanding. Seed companies, previously viewed with scepticism for producing GMOs, are now viewed positively. A lucrative and valuable market is therefore foreseen for agriculture in the immediate future[1]. Much of the products of seed companies are protected by intellectual property rights. Could this signal a recognition of the importance of intellectual assets on improving agricultural productivity?

Throughout the 20th century, improvements in agricultural productivity have considerably alleviated poverty and starvation and fuelled economic progress. Further, a large body of evidence closely links the use of intellectual assets for productivity improvements to investments in agricultural research and development (R&D).[2] Agricultural R&D is therefore a prime target for investment where global demand currently outstrips production. Given the rates of return that research usually delivers, the anticipated impact of well directed investment are new technologies that increase yield, enhance resilience and in many ways ensure efficient production of agricultural products.

2. CONTRIBUTION OF AGRICULTURE TO SOUTH AFRICAN ECONOMY

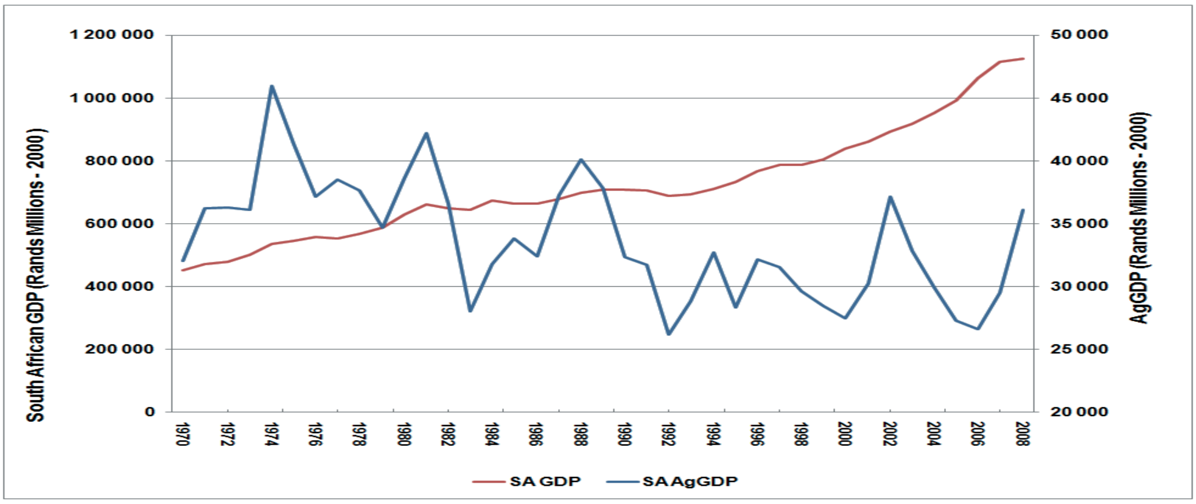
2.1 Agriculture's contribution to GDP

The agricultural sector in South Africa is defined as all activities relating to agricultural input provision, farming and the processing and distribution activities that add value to farm products. It is therefore a backbone of growth and development in South Africa because it provides a strong foundation and support to other sectors of the economy. Purchases of goods such as fertilisers, chemicals and implements form backward linkages with the manufacturing sector, while forward linkages are established through the supply of raw materials to industry. It is important to note that about 70% of all agricultural output is used as intermediate products.[3] Combined, the primary production plus the secondary input and agro-processing sectors forms the “agro-food” complex which is an important sector in the South African economy, accounting for about 14 – 15% of the country's GDP[4].

Primary agriculture consists of production within the boundaries of the farm gate and accounts for less than 5 % of the country's GDP; however 25% of the manufacturing industry comes from agroprocessing. The total manufacturing industrial sector contributes about 37% to the GDP. South Africa's food processing sector could potentially generate economic growth, entrepreneurial opportunities and employment[5]. The Food and Agriculture Organisation's (FAO's) has argued that “because of its high degree of interdependence with forward and backward activities, the agro-industry could be critical for accelerating economic growth”[6].

The graph below shows the growth in primary agricultural contribution to GDP from 1970 to 2008. This graph indicates that the primary sector's GDP contribution has declined from 7.0 % in 1970 and to an average of 2.85% over the last 5 years. Overall however, the sector has grown by an average of approximately 11.8 % per annum since 1970.

FIGURE 1: Real Agricultural Contribution to Gross Domestic Product (1910 – Q2 2009) 2000 Values[7]

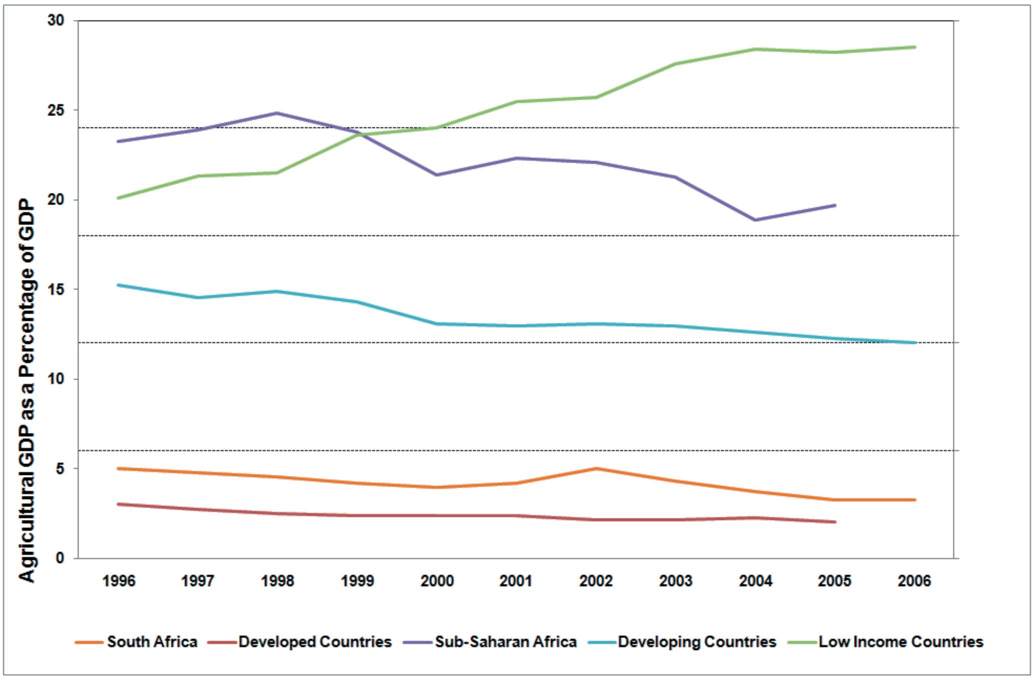


It is well known that the greater the development of a country, the smaller the contribution of primary agriculture to the GDP tends to be.[8] As GDP per capita rises, agriculture's share declines, and so does its contribution to economic growth. This happens while agricultural output simultaneously increases in absolute value, because the non-agricultural sectors are growing faster. Agroprocessing, listed in the manufacturing sector, for example tends to increase as development proceeds, and as this is listed in the manufacturing sector, an apparent decrease in the contribution to GDP of the agricultural sector occurs.

This apparent decline in primary agriculture's share of the GDP hence does not imply a reducing role of the agricultural sector in the country's economy, but is rather a direct consequence of total economic growth in South Africa which was 14.9 % per annum over the same period. The trend reflects the nature of the South Africa's economy which is in the process of transforming from that of a dependence on the primary sector (agriculture and mining) to a broadly diversified manufacturing and services economy, both of which have an increased contribution to GDP. Such transformation of the economy suggests a greater role for a knowledge based economy where intellectual assets are critical towards success. This observation is therefore a normal phenomenon in global economic development and in fact indicates a maturity of the sector rather than a lack of importance. Further support of this conclusion is provided by the impact of climatic event such as droughts or periods of exceptionally favourable rainfall, negatively affect the national GDP by as much as 0.5 to 2%[9].

The graph below places South Africa in context of other regions internationally indicating that in some respects South Africa has the appearance of a relatively developed country. With a primary agricultural contribution to GDP of 2.7%, South Africa can be likened to developed countries which globally in 2005 had a contribution of 1.7%. In contrast, developing countries had GDP 10.2%. The Sub-Saharan African regions agricultural contribution to GDP was 16.4%. However, caution should be exercised on this as it fails to reflect the role of communal and subsistence farmers in the economy.

FIGURE 2: Agricultural GDP as a Share of Total GDP[10]



The preceding statistics suggest that South Africa is in a better position than many developing nations, but can improve considerably compared with the major industrialised countries. An economy with a strong manufacturing sector along with the services industry provides an indication of the importance of intellectual assets in generating value to agricultural production. As downstream value-adding contributes significantly to total GDP, and disproportionately to the primary agricultural production, the implication is that it is advantageous for a country to develop agricultural value-adding activities.

The table below shows that the livestock industry is the largest national agricultural sector with 47.5% of the value of production. [Gross farming income refers to both that part of agricultural production that is marketed and production for own consumption, valued at basic prices.] Gross income from all agricultural products amounted to R126 273 million for the year ended 30 June 2009, which is 13.7 % higher than the previous year. This increase can be attributed to increases of 19.3, 12.3 and 10.3 % in the gross income from field crops, animal products and horticultural products, respectively.

TABLE 1: Gross Value of Agricultural Production July 2008 – June 2009[11]

Field Crops Rands Million (Current)		Horticulture Rands Million (Current)		Animal Products Rands Million (Current)	
Maize	18 317	Vegetables	10 797	Poultry	20 765
Wheat	5 036	Deciduous & other fruit	7 638	Cattles & Calves Slaughtered	13 133
Sugar Cane	4 559	Citrus fruit	5 683	Fresh Milk	9 186
Sunflower Seed	2 350	Viticulture	3 304	Eggs	6 573
Tobacco	221	Sub tropical Fruit	2 097	Sheep Slaughtered	3 077
All Field Crops	**35 248**	**All Horticultural Products**	**31 033**	**All Animal Products**	**59 992**

Broadly, the agriculture GDP contribution by the field crop industry has steadily declined over the past 30 – 40 years whilst the horticulture sector has increased from 16 to 27%. This further validates the transformation of the South African agricultural industry to that more closely resembling that of developed world. During the same period, the horticulture sector has significantly increased its investments into agricultural research, thereby generating intellectual assets (mainly cultivars and processing technologies) for sustained productivity and competitiveness.

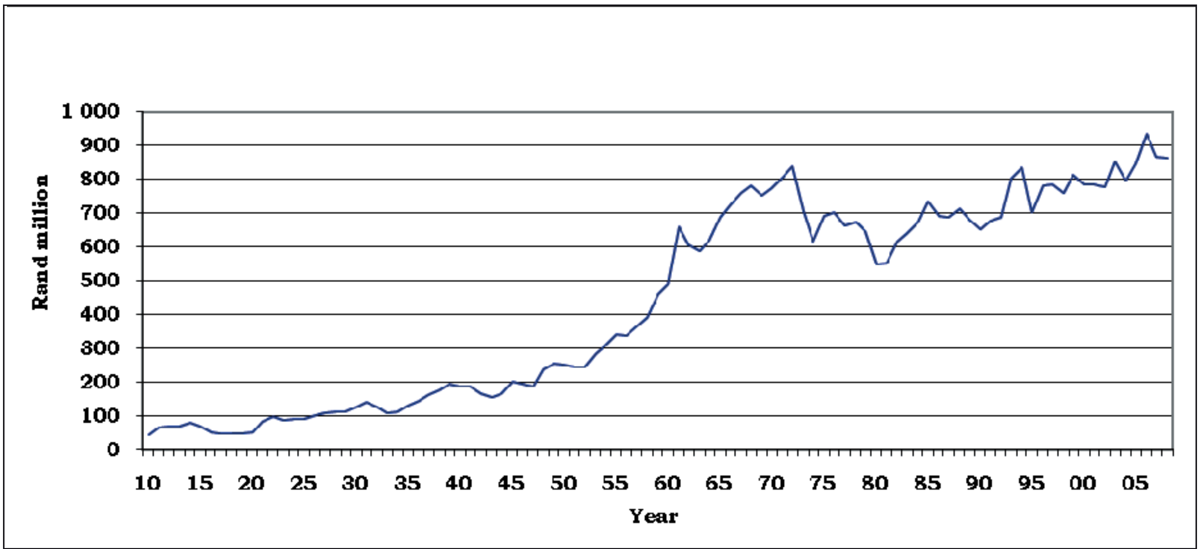
South Africa is one of the world's leading exporters of agro-food products. Agricultural exports grew faster than other exports during the mid-1990s as the economy opened up, with agricultural exports contributing on average about 8% of total South African exports over the past 5 years. Agriculture therefore remains a major earner of foreign exchange and in this process contributes substantially to economic growth.

South Africa's net trade of agricultural products to the world remains positive in the face of the world economic recession. Since 2002 South Africa started to encounter a declining trade balance on processed products that led to a strong trade deficit from 2007 onwards. The cause of South Africa becoming a net food importer in 2007 for the first time was partly as a direct consequence of diminishing food processing capacity[12], coupled with the strengthening of the exchange rate during the period prior to the world food price bubble in 2007[13]. There was thus a drastic increase in the cost of imported goods coupled with less competitiveness on exports. Much of the trade deficit is caused by the increased prices of imported goods. In addition, during the same period and beyond, South Africa had under – invested in agricultural research and development; which resulted in fewer intellectual assets for competitiveness.

3 AGRICULTURAL RESEARCH AND DEVELOPMENT INVESTMENT TRENDS

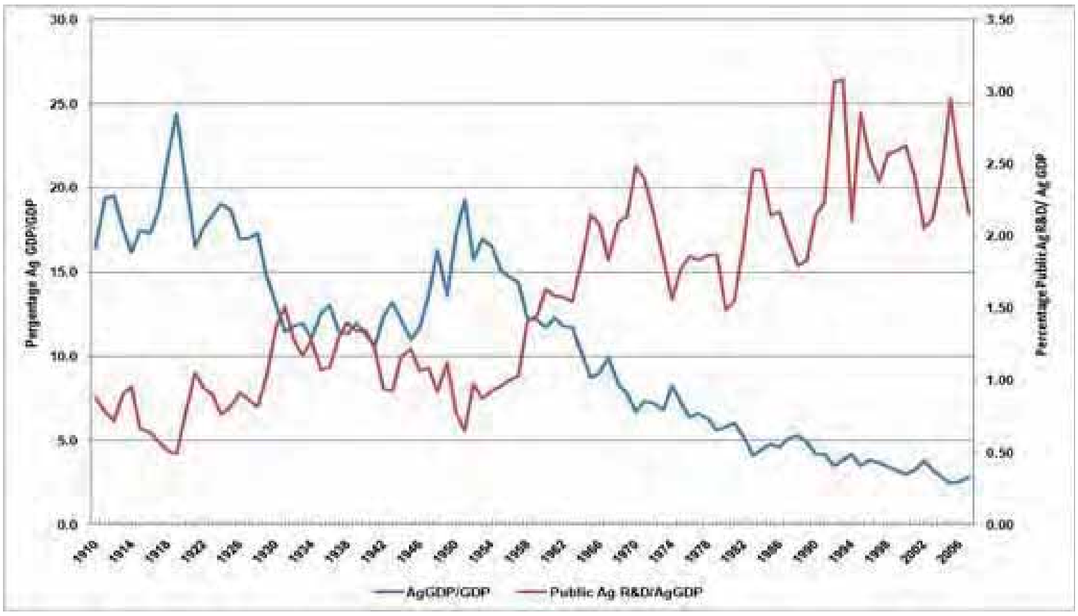
The figure below illustrates the trends of total expenditure by the South African public sector on agricultural R&D since 1910 (in constant 2000 values) indicating that real public agricultural R&D grew steadily by an average of 5.2% per year until 1953. The pace of growth accelerated over subsequent years to a peak in 1972. Thereafter, real public spending in agricultural R&D failed to grow significantly, declining by an average of 5.7% per annum until 1980 after which it slowly recovered until 2005. Excluding external income generated by the ARC from these values, public agricultural R&D spending over the 1971-2005 period (except in 1994, 1996 and 2005) was below the inflation adjusted 1972 amount.

FIGURE 6: Real South African Public Agricultural R & D Spending Trends, 1910 – 2008 (2000 values)[21]



Placing a country's agricultural R&D efforts in an internationally comparable context requires measures other than absolute levels of expenditures such as the intensity of investments in agricultural research. The most common research intensity indicator (RI) is that of the ratio of public agricultural R&D spending in relation to the sector's contribution to the economy. Outputs of agricultural research are predominantly intellectual assets, which become utilized to increase productivity and competitiveness. Therefore, the interrelatedness between public agricultural R & D expenditure and the sector's contribution to GDP become critical. The figure below illustrates this trend since 1910.

FIGURE 7: R&D Investment Intensity and Agriculture's GDP Contribution: 1910-2008[14]



This graph indicates that in the early years of 20th century, South Africa invested little in its own research expenditure; instead relying mostly on research spill-overs, often in the form of intellectual assets, from other countries. This graph also indicates that the only period within the past century where South Africa was able to increase the agriculture's contribution to the economy occurred in the decade following the World War II, where the AgGDP/GDP ratio increased from 10.6% in 1940 to 19.2% in 1950[15]. Notably, this increase was preceded by a steep increase in the RI a decade earlier. During the period 1995 - 2000, the RI increased slightly despite declining total agricultural R&D spending. This was however primarily due to a stronger decline in real AgGDP during this period rather than increased investment.

In the last 20 years global public investment in agricultural research and development has declined. This decreasing trend in public funding experienced worldwide is attributed to a variety of factors, including other perceived priorities, poor marketing of the real contribution of research, a lack of understanding by decision-makers and inadequate links between research management and policy makers. The emphasis in developed countries is no longer in simple productivity enhancement but rather in favor of enhancing certain attributes of food, such as so called "functional foods", and food production systems such as organic farming. [16] Consequently, private sector agricultural R&D funding has risen much more rapidly than public sector funding, in response to market incentives.[17]

Nevertheless, whilst dietary patterns and other priorities change as incomes increase, food security concerns remain a major concern amongst the developing word. Since developed countries still account for close to 41% of public agricultural R&D, the consequences of this market trend could be pronounced in terms of productivity prospects in agriculture. In addition, it has been suggested that a more important consequence is that slowdowns or cutbacks in developed country spending will curtail the future spill-overs of ideas and new technologies from rich to poor countries.

4 IMPACT OF AGRICULTURAL RESEARCH

Demand for food continues to grow due to increases in both population and income. Sustained growth in productivity from agricultural lands already in use is thus essential to improve food security, as there is little potential for expansion of farmland area. It has been proven repeatedly globally, and in South Africa, that sustained well-targeted and effectively used investments in R&D can have a direct impact on improved agricultural productivity[18] and access to cheaper, higher quality foods and fibres[19]. Furthermore, investment in research and new agricultural techniques directly boosts rural incomes and increase exports hence alleviating poverty and starvation and stimulating economic growth.[20]

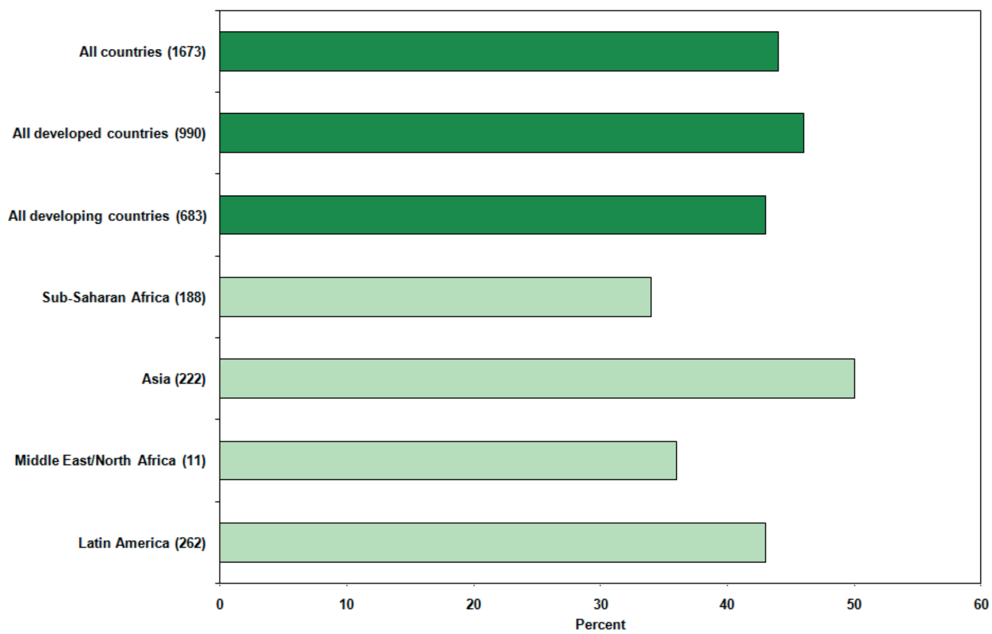
Without investment in R&D, yields will decline from present levels as new pests and diseases threaten agricultural production and hence, reducing hunger while protecting the environment is not possible. Investments in agricultural R&D that complement other policy measures in enhancing incentives to producers and building infrastructure will continue to play a critical role in promoting agricultural productivity and food security.

4.2 International evidence

Qualitative international research consistently provides evidence that rates of return to public agricultural R&D for society are very high, justifying both past investments and increased funding in the future. Yet, over recent years as has been outlined above, there has been a decrease in public funding for agricultural R&D. This decrease has not been justified by the growing needs of the agricultural sector.[21] Among the reasons for this decline are greater private funding of agricultural R&D in the developed countries and pressures for increased accountability for the use of public R&D funds. A further difficulty is that estimates can be complicated by the lag time between investing in R&D and reaping a return on that investment.

Technological innovation, in combination with policy reform is crucial for agricultural growth and general economic development, according to the World Development Report 2008: Investment in agricultural research delivered an average rate of return of 43% in 700 projects evaluated in developing countries. The graph below indicates that returns are high in all regions, in both developing and developed countries including Sub-Saharan Africa.

FIGURE 11: Estimated returns to investment in agricultural R&D[22]



4.3 South African evidence

In South Africa a few seminal studies were completed to determine the return on investment of specific research programmes (refer to Appendix 1 for more details). These rate of return studies determined the ratio of money gained or lost on an investment relative to the amount of money invested, often expressed as a percentage. Returns ranged from a national average of 30 – 44% with return on investment in horticulture leads exceeding 100%. Investment in livestock was 5%, however when modelled separately whereby expenditures on both research and dipping were used to explain the decline in animal losses, a return (in terms of animals saved) of 36% is recorded. Rates of return on investment of over 100% were recorded recently in a study that measured the socio-economic impact for the Grain Production and Advancement Project.[23]

5 ROLE OF THE ARC

The Agricultural Research Council (ARC) is one of the most important entities within the national system of Innovation (NSI) serving as South Africa's primary agricultural research and development institution. The mandate of the ARC is to conduct research, develop technology and disseminate the results of its research (technology and information) in order to:

- Promote agriculture and industry;
- contribute to the improvement of the quality of life of the people of South Africa, and by extension, the global community; and
- Facilitate / ensure natural resource conservation.

ARC's role is thus to support and facilitate the success of the agricultural sector through science and technology innovations. The organisation's strategic objectives and related outputs are hence aligned with the strategic objectives of the Department of Agriculture, Forestry and Fisheries, which is to "lead and support sustainable agriculture and promote rural development". In pursuit of the vision and mission, the goal of the National Agriculture R&D strategy is to enhance the contribution of agricultural research towards attaining at least a 6 % economic growth rate through sustainable agricultural productivity, sustained competitiveness to ensure food security and eradication of poverty in South Africa.

The ARC plays a pivotal role in the economy of South Africa and contributes to improvements in the quality of life of people. Through conducting research and development the ARC serves as a catalyst towards productivity improvements, mitigation of risks from pests, diseases and climate change; which in turn result in economic growth, rural development and poverty alleviation. Such outcomes cannot be achieved without consistent and sustained public investments in agricultural research, particularly at the ARC.

The organisation performs its functions through several research institutes that are predominantly commodity based and agro–ecologically distributed throughout the country. These Institutes can be clustered into five business divisions, namely, Animal Health, Animal Production, Grain Crops, Horticulture Crops, and Natural Resources and Engineering. The ARC has also been mandated to manage and maintain National Public Assets on behalf of the Departments of Agriculture and Science and Technology. The National Public Good Assets are comprised of national collections (gene banks) of animals, bacteria, animal databases, range and forage gene bank, fungi, genetic material, insects, plants, yeasts and viruses to mention a few. These provide important sources for food security, scientific reference, genetic material for future use and development, as well as rehabilitation of planting and breeding stock for national recovery from natural disasters.

The ARC has been instrumental to the success of the agricultural sector through its mastery of science and technology. It has contributed to the increased market share of many agricultural commodities including deciduous fruits, tropical and subtropical fruits, grains, red meat, dairy, poultry and wine to mention a few.

This has been achieved through the generation and dissemination of new varieties, technologies, information, technical know – how and general knowledge. Further, the ARC has contributed towards sustainable use of natural resources through research, technology development and information dissemination, particularly aimed at providing decision support systems.

The ARC is thus an important entity for contributing towards agricultural development, particularly among resource poor farmers and land reform participants. Investments have been critical towards successful efforts to eradicate pests and diseases. Research, technology development and technology transfer are important elements for the success of the competitiveness of the agricultural sector, particularly for market access purposes and science and technology emanating from the ARC has been demonstrated as being critical towards transforming the country into a knowledge economy. Analyses of rates of return on investments into research and development by the ARC suggest that the organization has been highly instrumental towards contributing to agriculture's success in the economy.

6. TECHNOLOGY TRANSFER MECHANISMS

In order to effectively contribute to the enhancement of agricultural productivity, the ARC utilizes a variety of instruments to disseminate results of research and development; which are mainly in the form of intellectual assets. The ARC's intellectual assets are in the form of trade secrets, copyright, handbooks, manuals, leaflets, CD Roms, posters, course material, books, photo libraries, patents, plant breeders' rights, and registered trademarks to mention a few. The majority of ARC's intellectual assets are in the form of plant breeders' rights and publications. Plant breeders' rights enable the ARC to distribute new cultivars that are important for enhancing agricultural productivity. Similarly, scientific publications enable the organization to disseminate information emanating from research in order for farmers to solve productivity problems. Patents provide a good mechanism to distribute through an agreed process, a particular invention for use in enhancing agricultural production. The majority of ARC's patents are in the form of vaccines and instruments (machinery) used in agriculture.

In order to ensure that intellectual assets are effectively managed, the ARC has developed and implemented an Intellectual Property Management Policy. This policy provides for timely filing of applications for patents, Plant Breeders' Rights, copyright etc; and requires employees to disclose of all information regarding any new invention as soon as possible. The policy is also used to evaluate all research and development activities for decision making on the utility of some products, mainly in agriculture. Benefit – sharing mechanisms are enshrined within the policy, for the inventors, contributors to the invention and the ARC.

Further, the ARC as a public entity in South Africa is obliged to ensure that the innovative outcomes from its research and development initiatives are effectively disseminated. Therefore, the ARC has developed mechanisms for the dissemination of its intellectual assets. All intellectual assets are disseminated within the context of the Intellectual Property Management Policy. Broadly, the ARC utilizes three main approaches for disseminating intellectual assets:

a) **Direct transfer:** In this case a number of different types of technology and information dissemination approaches are used by the ARC. For example, specific training on animal performance recording is conducted with farmers who participate in an animal improvement scheme. The aim is to enable the farmers to utilize scientific information emanating from ARC research for decision making in the management and production of their livestock. This particular animal improvement scheme has recruited in excess of 300 small scale and resource poor livestock farmers; with a net impact of increased income. Another project was about training and information dissemination in the Eastern Cape province of South Africa. Approximately 2500 households in 52 villages were trained on tree cultivation, orchard management and harvesting of tropical and sub – tropical fruit trees (e.g. mango, avocado, macadamia nuts, litchi etc). Approximately 100 000 fruit trees were disseminated among the villagers for planting and they're now harvesting the fruits and selling at the markets. In addition, the same villagers were trained on intercropping to enable vegetable farming for food security.

b) **Agency mandate:** This refers mainly to a licensing arrangement for the distribution and marketing of ARC intellectual assets, often applied to cultivars and patents. For example, the ARC would license potato cultivars to Potato South Africa a producer organization representing the interests of potato farmers. In turn, Potato South Africa would make available to their members the same cultivars on a non – exclusive basis for evaluation. Upon satisfactory performance of the specific cultivars, producers would enter into competitive bidding among themselves for exclusive licenses for the commercialization of the cultivars. Licenses are awarded on the highest bid presented and ARC would in turn receive royalties on potato sales annually.

Wheat and barley cultivars developed by the ARC dominate the South African grain industry, where the organization enjoys 70% of the market share. In consultation with the grain industry, the ARC develops specific cultivars aimed at responding to customer needs and obtains Plant Breeders' Rights. Performance of the cultivars is measured in the National Cultivar Evaluation Programme. This programme enables comparison of different cultivars from a variety of organizations (including the private sector) under the same conditions. Further, the Cultivar Evaluation Programme serves as an information dissemination platform for farmers. All cultivar performance data are published and made available to producers. The ARC then invites bidders for the exclusive marketing rights of ARC cultivars. To date, the main clients have been Monsanto, Pannar, Sensako etc.

c) **Partnerships:** The ARC has entered into a partnership in a project called: "Improved Maize for African Soils" (IMAS). A public – private partnership aimed at developing and disseminating royalty – free, nitrogen use efficient (NUE) maize cultivars improved using conventional breeding, marker – assisted breeding and molecular breeding for use by smallholder farmers in Africa. The project partners are the International Maize and Wheat Improvement Center (CIMMYT), Agricultural Research Council, Kenya Agricultural Research Institute (KARI) and Pioneer Hi – Bred International. The Bill & Melinda Gates Foundation and USAID are funding the project through a grant to CIMMYT. Preliminary results indicate an increase of 20 % in the yield of new maize cultivars grown in nitrogen deficient soils.

Research and development outcomes and associated mechanisms for technology transfer have been instrumental to the ARC's contribution to improved agricultural productivity. On the basis of evidence presented above, it's clear that effective management of intellectual assets coupled with innovative mechanisms for technology transfer are critical to sustainable agricultural productivity improvements and economic development. The ARC has been successful mainly because it has deployed all its intellectual assets (registered and unregistered intellectual property) towards ensuring the success of the agricultural sector in South Africa. For example, when comparing income generated from licenses as a proportion of expenditure on research and development against similar institutions (using information obtained from annual reports and annual financial statements for 2009), the ARC ranked third in performance.

APPENDIX 1[1]

		1970s	1980s	1990s	2000-2007
Indicator	**Unit**	***Ten Year Average***			
Farming Structure					
Farm Number	Number	79 842	64 540	59 108	44 575
Total Area	1000 ha	86 814	85 862	82 502	83 888
Average Farm Size	ha	1 094	667	1 265	1 404
Economic Contribution					
AgGDP	R million (2000)	37 594	35 877	30 201	31 217
Contribution to GDP	Percent	6.8%	5.0%	3.7%	3.0%
Labour					
Economically Active in Agriculture	'000	2 483	1 181	1 213	1 406
Agricultural Share of Total	Percent	31	14	10	12
Farm Employees	'000	1 639	1 235	1 185	785
Value of Production					
Field Crops	R million (2000)	26 524	23 657	15 677	16 176
Horticulture	R million (2000)	9 525	10 323	11 392	14 350
Livestock	R million (2000)	21 761	24 775	20 518	23 564
Total	R million (2000)	57 810	58 755	47 586	54 091
Share of Production Value					
Field Crops	Percent	46	40	33	30
Horticulture	Percent	16	18	24	27
Livestock	Percent	38	42	43	44
Govt Expenditure on Agriculture					
Dept of Agriculture (DoA)	R million (2000)	1 331.0	1 953.7	2 068.7	3 129.1
Total Spending on Agriculture	R million (2000)	4 579.9	5 217.5	3 176.0	3 415.7
Total Government Spending	R million (2000)	107 242	150 327	204 496	251 304
Agricultural R&D	R million (2000)	659.7	615.3	723.5	760.2
Expenditures Shares					

1 Liebenberg, F. PG Pardey, & M Khan. *South African Agricultural Research and Development: A Century of Change*. Staff Paper Series. ## Department of Applied Economics, International & Technology Practice and Policy. College of Food, Agricultural and Natural Resource Sciences, University of Minnesota, St Paul. submitted for publication to *Agrekon* 2009 (In preparation)

DoA/Govt Spending	Percent	1.2%	1.3%	1.0%	1.2%
R&D/DoA Spending	Percent	49.6%	31.5%	35.0%	24.3%
R&D/AgGDP	Percent	1.8%	1.7%	2.4%	2.4%
Total Spending on Agriculture/ Total Government Spending	Percent	4%	3%	2%	1%

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APPENDIX 2

Table 8.8 South Africa: Rate-of-return studies on the impact of agricultural research by level of aggregation

Level	Commodity	Method	Period	Rate of return (percent)	References
National	Research and development	Two-stage decomposition	1947–91	60–65	Thirtle and van Zyl 1994
	Extension			28–35	
	Research and development	Profit function	1947–92	44	Arnade et al. 1996; Khatri et al. 1995
	–Short-term				
	–Long-term			58–113	Arnade et al. 1996; Khatri et al. 1995
	Extension			Very low	Arnade et al. 1996; Khatri et al. 1995
Agricultural subsectors	Field crops	Profit function	1947–92	30	Thirtle et al. 1998
	Horticulture		1947–92	100	Thirtle et al. 1998
	Livestock		1947–92	5	Thirtle et al. 1998
Enterprises	Animal health	Production function	1947–82	>36	Thirtle et al. 1998
	Animal production	Supply response	1947–94	11–16	Thirtle et al. 1998
	Bananas	Supply, area, and yield	1953–95	50	Thirtle et al. 1998
	Deciduous fruit	Supply response	1965–94	78	Thirtle et al. 1998
	Groundnuts	Yield changes	1968–95	50	Thirtle et al. 1998
	Maize	Error-correction model	1950–95	29–39	Thirtle et al. 1998
	Sorghum	Error-correction model	1950–95	50–63	Thirtle et al. 1998
	Sweet potatoes	Supply response	1952–94	21	Thirtle et al. 1998
	Tobacco	Supply, price lags	1965–95	50–53	Thirtle et al. 1998
	Wheat	Error-correction model	1950–95	26–34	Thirtle et al. 1998
	Wine grapes	Error-correction model	1987–96	40–60	Townsend and van Zyl 1998
Research programs	Dairy, beef, mutton, and pork performance, and progeny testing schemes	Economic surplus	1970–96	2–54	Mokoena, Townsend, and Kirsten 1999
	Cover-crop management	Yield and residual	1987–96	44	Thirtle et al. 1998
	Lachenalia research and development[a]	Economic surplus	1965–2015	7–12	Marasas et al. 1998
	Proteaceae research and development[a]	Economic surplus	1974–2005	8–12	Wessels et al. 1998
	Russian wheat aphid integrated-control program[a]	Economic surplus	1980–2005	22–28	Marasas 1999

Source: Compiled by authors.

[a]Preliminary results of these studies were published as reports by the Agricultural Research Council and the Southern African Centre for Cooperation in Agricultural and Natural Resources Research and Training.

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AGRICULTURAL RESEARCH COUNCIL – SOUTH AFRICA

WIPO SEMINAR: 14 JUNE 2011

AGRICULTURAL RESEARCH: ENHANCING PRODUCTIVITY THROUGH INTELLECTUAL PROPERTY

BY

DR. SHADRACK R. MOEPHULI
ARC: PRESIDENT & CEO

ARC • LNR

1

ARC MANDATE PER ACT

- To CONDUCT RESEARCH, DEVELOPMENT & TECHNOLOGY TRANSFER IN ORDER TO:
  - Contribute to better quality of life;
  - Facilitate/ensure natural resource conservation
  - Promote agriculture & industry;

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2

RESEARCH & DEVELOPMENT MANDATE

- GRAIN CROPS
  - Maize, sorghum, barley, sunflower, soya bean, dry beans, wheat, groundnuts, cowpea, bambara, tobacco, new crops
- HORTICULTURE
  - Vegetables, root & tuber vegetables, citriculture, subtropical crops, deciduous fruits, citrus, viticulture, temperate crops etc
- LIVESTOCK (production & diseases)
  - Cattle, sheep, goats, poultry, pigs, vaccines etc
- AGRICULTURE ENGINEERING
- NATURAL RESOURCES
  - Soils, climate, water, biocontrol etc

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3

SOUTH AFRICA & UPOV

- Member country to UPOV 1978
  - **Plant Breeder's Rights Act 1976 (Act 15 of 1976)**
  - Act amended in 1996 -- conformity to Constitution
- **Plant Improvement Act, 1976 (Act 53 of 1976)**
- SA Patents Act 57 of 1978 (as amended)
- SA Trade Marks Act 194 of 1993 (as amended)
- TRIPS Agreement
- **Intellectual Property Rights from Publicly Financed Research & Development Act 51 of 2008**

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4

GRANTED BREEDER'S RIGHTS

- Enables commercialization & technology transfer
- Conducted through Plant Improvement Act – variety listing
- Period of Breeder's right:
  - 25 years for trees and vines
  - 20 years for all other crops
  - Initial 5 years – exclusive rights
  - Remaining 15 years right – holder must issue licence to anyone requesting
  - National authority may expropriate rights for national interest – food security needs
  - National authority may issue a compulsory licence
  - Automatic expiry of rights following prescribed period
  - Farm saved seed allowed

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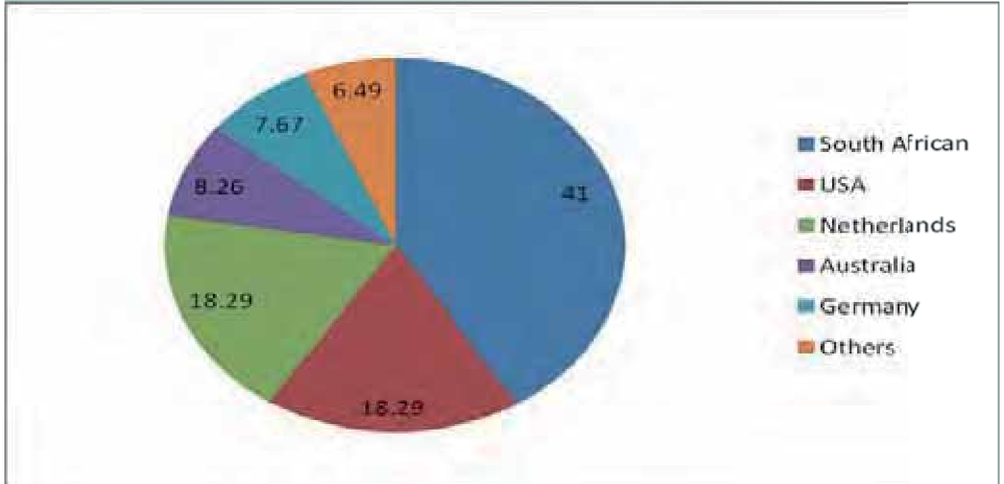
5

PBR OWNERSHIP IN SOUTH AFRICA

(PERCENT FOR 2009)



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6

ARC INTELLECTUAL ASSETS

Mainly Comprised of:

- **Plant Breeder's Rights – predominant**
- Patents
- Copyrights – publications
- Trademarks
- Trade secrets
- Know How
- Other unregistered IP

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7

IPR FROM PUBLICLY FINANCED R & D ACT

- **Purpose:**
  - **Publicly funded R & D must:**

  a) be protected;

  b) Utilized; and

  c) commercialized
  - **To benefit people of South Africa**
  - **Recipients of public funding act in a manner conducive to public good**
  - **Acknowledge & reward innovation**
  - **Enable economic growth through enterprise development**
  - **Allows publishing of scientific results**

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8

POSSIBLE EFFECT OF IPR ACT ON PUBLIC INSTITUTIONS

- Technology Transfer Office to manage IP
  - Disclosure
  - Identification, protection, development
  - Commercialization
  - Benefit – sharing arrangements
  - Reporting to National IP Management Office
- IP protection – benefit sharing arrangements
- Administrative impact
- Qualified IP experts to advice and manage

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9

POSSIBLE EFFECT OF THE IPR ACT IN SOUTH AFRICA

- **INVENTOR/RESEARCHER:**
  - **20 % of revenue for first R1 million**
  - **Thereafter at least 30 % of net revenue from institution from the invention**
  - **Good for the inventor – incentive & protection**
  - **Prescription is perceived as onerous**
  - **Most institutions already have benefit – sharing systems with inventors – often these provide for higher percentage for inventors**
  - **Compliance may reduce benefit – sharing percentages for inventors**

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POSSIBLE EFFECT OF IPR ACT ON PRIVATE SECTOR

- Majority of R & D projects are co – funded (public & private)
  - May result in administrative burden for institutions
  - may be disincentive for private funding of R & D
  - Still to learn impact on economy and the creation of new businesses
  - May lead to reduced co-funding arrangements
  - May lead to increase in the development of trade secrets by private entity
  - Impact on agricultural productivity remains unclear

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11

ARC INTERPRETATION OF THE IPR ACT

- ARC Intellectual Property Rights Policy
- Technology Transfer Office
  - Intellectual Property Manager
  - Commercialization Manager
  - Corporate Legal Advisor
- **Policy used for technology transfer**
  - **Licencing**
  - **Commercialization**
  - **Income generation**
  - **Investment into R & D**

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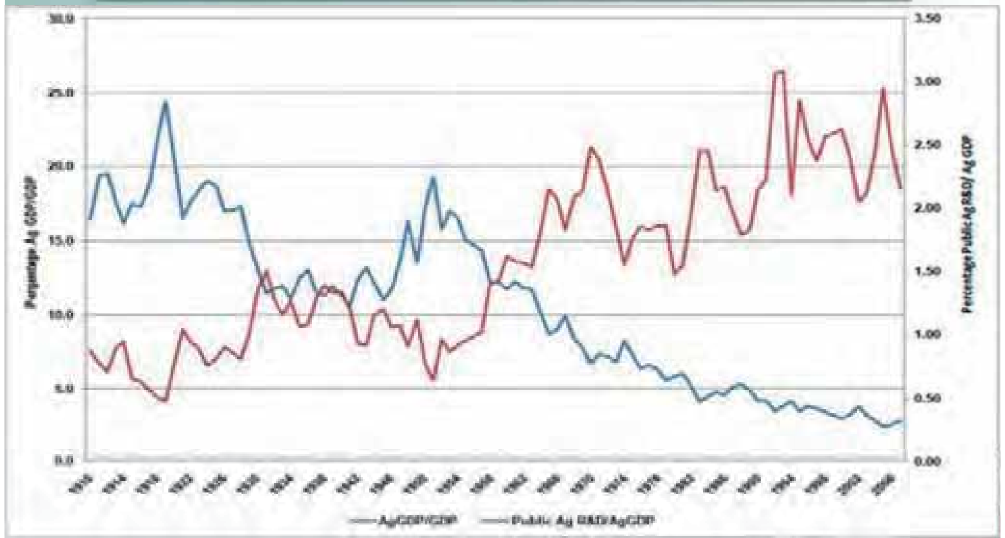
12

R & D INTENSITY & AgGDP CONTRIBUTION 1910 – 2008



13

IP Technology Transfer Mechanisms

- **Direct Transfer**
  - Advisory Services for Livestock Productivity
  - Publications for productivity enhancement
  - Training for productivity improvements
  - Information dissemination
- **Agency Mandate**
  - Licensing
  - Contract arrangements
- **Partnerships**
  - Project partnership
  - Consortium arrangements

14

FAMACHA: Checking a goat for anaemia in Nkwezela Village (Bulwer), KwaZulu-Natal

15

Dissemination

FAMACHA© system taken up by Farming Systems Research and farmers being trained

16

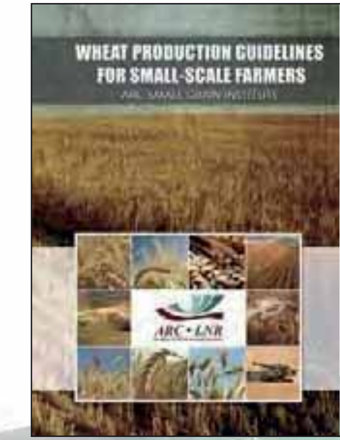
NATIONAL WHEAT CULTIVAR EVALUATION PROGRAMME

- Conducted in all provinces, at 67 localities testing 76 cultivar/ environment interactions
- Data published in the Production Guidelines for small grain production (four publications)
- Distributed to 8000 small grain producers
- Scientifically founded and objective decision-making guideline for producers

17

PRODUCTION GUIDELINE FOR EMERGING COMMERCIAL SMALL GRAIN PRODUCERS

- First publication of this kind aimed at emerging commercial producers
- Contains all information on production practices for small grain production
- English copies distributed to 1000 producers already
- Copies of same publication in Sesotho available



18

Cotton Plant Protection Training – SADC Region

- **Malawi** (2 workshops)
  - **90 Extension officers trained**
  - **Serving 75,000 small-scale farmers**
- **Zambia** (3 workshops)
  - **120 Extension officers trained**
  - **Serving 45,000 small-scale farmers**
- **South Africa** (1 workshop)
  - **17 Chief Extension Officers trained**
  - **4 Provinces (NW, Mpumalanga, Limpopo, KZN)**
  - **Serving 1000 small-scale farmers**
  - **Promoting cotton as a cash crop**

19

MARKET SHARE OF ARC IRRIGATION CULTIVARS FARMER'S DEMONSTRATION

- ARC currently at 40% market share of wheat cultivars produced under irrigation conditions in the RSA
- 2250 tonnes of ARC cultivars sold and produced in the 2009/2010 production season
- 25000 ha under irrigation planted to ARC cultivars
- Irrigation wheat is a significant stabilizing factor in the production of bread products in the RSA

20

MARKET SHARE OF THE BALREY CULTIVAR PUMA UNDER IRRIGATION

- 5700 ha under irrigation in the Northern Cape and Northwest Provinces planted to Puma
- This represents 58% of the total barley production in the irrigation areas
- Total production of 35000 ton Puma realised in these areas
- Puma is a significant stabilising factor in supplying malting barley to the industry

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21

Technology Transfer: Licensing – CULDEVCO

- In 2009 the ARC released 11 new varieties to the South African stone fruit industry. The varieties released, are either replacing older and non-performing varieties, or will fill important harvesting gaps in the season. The eleven new varieties are made up of

  four plums
  five peaches
  two nectarines

- Of the four plums, two have a full red, one a black and one a yellow skin colour. Of the peaches, three were for the dessert industry, one for the canning industry to extend the harvesting season, and one for the drying industry. Of the two nectarines released, one is a very early variety for the fresh market. The second variety which is being marketed as "Colorburst™", will extend the drying season for the yellow skin nectarines suitable for drying. "Colorburst™" is the trade mark registered for the unique range of yellow-skin nectarines bred by the ARC and is currently sold exclusively by Woolworths in South Africa.

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22

CULDEVCO – COMMERCIALIZATION

Commercialization (cultivars released + all other related activities)

- A new blushed pear selection, with the trade name Cheeky™ was released to Deciduous Fruit Industry. The uniqueness in this cultivar lies in the ability to keep its delicate blush during warm periods, good storage ability of up to 12 weeks and pleasant taste after storage. Cheeky comes on the market when there are no other blush pears. Blush pears fetch premium prices. Result of a breeding programme.

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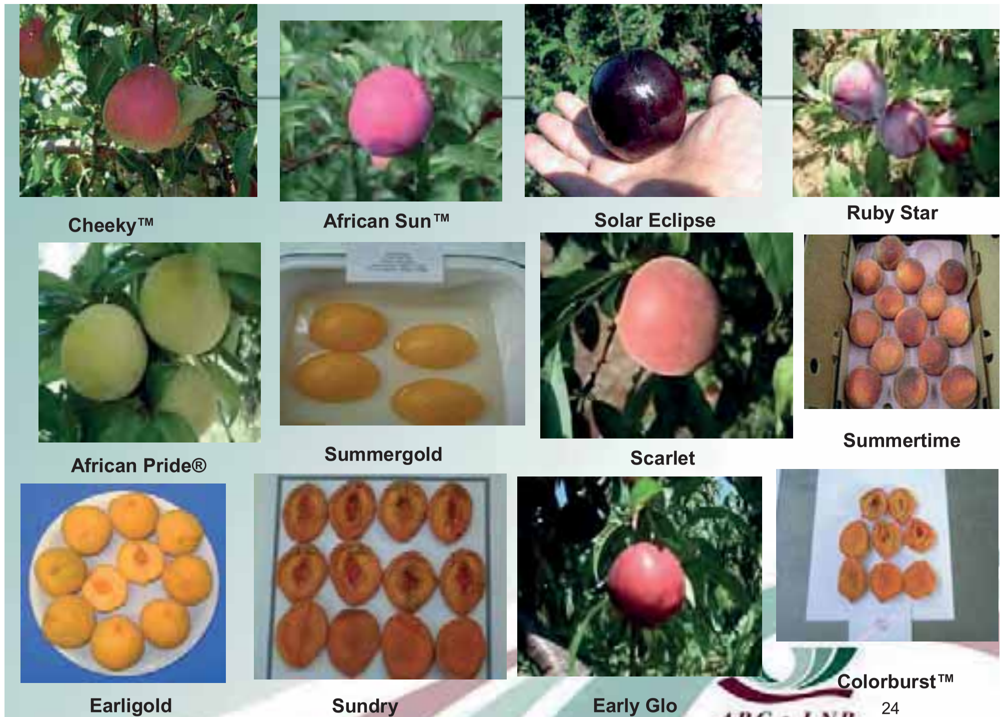
23



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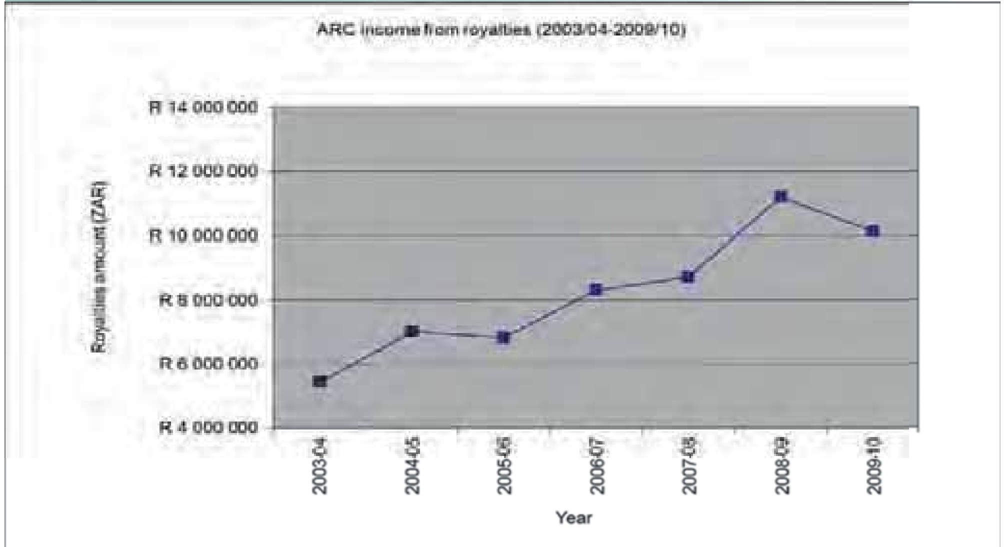
24

IMPACT OF LICENSING ON ARC



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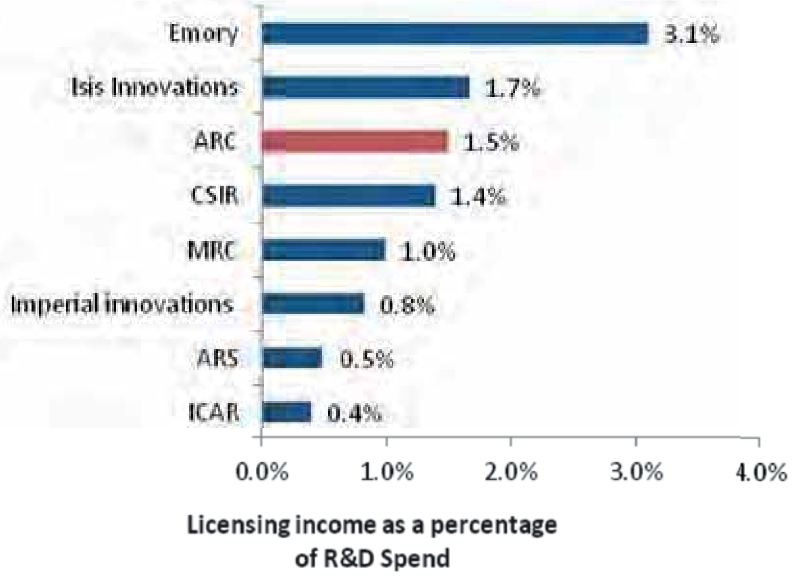

26

The ARC has bred a new citrus cultivar called 'Sonet' and although it is still being evaluated, it has already attracted huge interest from citrus farmers. The response to a presentation at a citrus growers day organised at Addo Research Farm to inform citrus farmers about the qualities of 'Sonet' was overwhelmingly positive. The cultivar has also attracted international interest and indications that this citrus cultivar will be sought after on global markets. The cultivar will be released for commercial production once the comprehensive evaluation process has been concluded and will enhance the competitiveness of South African citrus farmers on global markets.

The new 'Sonet' Mandarin selection

27

• Vaccines developed against parasitic nematodes:

Vaccine against internal parasites (*Haemonchus*: nematodes) for sheep and goats is a crude homogenate of adult worms. The vaccine use results in the increase of the income generated by resource-poor farmers and commercial farmers by increasing the animal productivity and cutting the huge spending in treatment of the herds. The vaccine is cheap to produce and to sell. It is produced in collaboration with Moredun Research Institute, UK.

30 Boer goats vaccinated & protected

Goats vaccination

28

ARC's IP: SIT (Sterile Insect Technique)

Some excellent progress has been made with the sterile insect technique (SIT) programme, which currently includes false codling moth (the most important insect pest for the citrus industry, but also a pest on stonefruit and table grapes), and Mediterranean fruit fly and codling moth, both key pests on deciduous fruit. A programme funded by government for productivity.

River, and the Warm Bokkeveld, Tulbagh/Wolseley, Kaaimansgat and Langkloof areas. Two additional areas where fruit farmers are developing on their farms, viz. Klein Swartberg and Prince Albert in the Karoo region, are also due to start a fruit fly monitoring programme with a view to later implenting SIT.

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Partnership: SmartFreshSM Technology

Commercialization in South Africa

Control

SmartFresh Treated

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USE OF IP FOR BENEFIT – SHARING

- *As a public entity ARC utilizes IP to enhance benefit sharing:*
  - *Effective technology transfer – mainly for agriculture development and growth*
  - *Enable competitiveness of the agriculture sector*
  - *Contribute cultivars that are important for food security*
  - *Incentivise innovation through:*
    - *Further investments into Research and Development*
    - *Providing a share of the revenue generated to inventor*
    - *Stimulate enterprise development*
    - *Facilitate access to poor farmers for development & productivity*
- *Intellectual Assets are critical for Agricultural productivity!*

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Token of appreciation from Bulwer farmers To ARC Team: Christmas cake

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Re a Leboha

Siyabulela

Siyabonga

Siyathokoza

Ha khensa

Ria livhuwa

Baie dankie

THANK YOU

ARC • LNR

Transcription of Q&A Dr. Stephen Mbithi Mwikya and Dr. Shadrack R. Moephuli

Q. – Mrs. Caroline Dommen (Quaker United Nations Office, Geneva) to:

1) Dr. Stephen Mbithi (FPEAK): I was fascinated by your analysis of the payments of royalties and what that sum could do if used to stimulate the national industry and the collaboration between breeders, propagators, farmers and producers. Could you say more about whether initiatives have been taken to move these ideas forward and whether you knew any examples also from other countries? You also mentioned the suggestion of formal representation of producers in UPOV. I was curious to know if you had any more details about that, whether you have had any discussions with your government delegation or whether similar discussions were in other countries.

2) Dr. Shadrack R. Moephuli (ARC): I was curious about whether there had been consideration in South Africa about joining UPOV 91, given that you are a member of UPOV 78. And then another question: you talked about plant breeders' rights. You said the national authority may expropriate breeders' rights for food security and I wanted to know if that had ever happened or if there had ever been any discussion about that.

A. – S. Mbithi: Firstly, the discussions so far with regard to the possibility of a much fairer mechanism between producers and breeders on royalties in Africa, especially in Eastern Africa: I think we are looking at the possibility whereby it could be based on market realities which are acknowledged by both, as opposed to the current situation whereby the breeders would sit and agree what they think will be viable and then regardless of market fluctuations that has to be paid. The discussions are a little bit made difficult by the fact that there is no international legal mechanism to back that approach. That means that sometimes the growers don't have a lot of leeway and, therefore, once you enter into a legal agreement at the beginning of a production cycle if things change halfway then that is difficult to address. It appears to be a little bit too one-sided at the moment. But I also say that we are trying to discuss. The good thing is that organizations like we who represent largely the growers also interact a lot with the breeders. The same is the case in the other countries, I know of the situation in Ethiopia. It gets serious when you look at the figures involved and, of course, the profitability involved, especially when a breeder could have the freedom to request differential payments for the same commodity from different growers for whatever reason. Obviously there are business realities; it is not the same when you are buying 10 stems than when you are buying 1 million stems, that's true. But the reality is that we are seeing increasingly situations where some growers might feel discriminated and sometimes seek State protection. This is what happened in Ethiopia recently where almost some Government action had to be called in for what could have been a purely a private matter between growers and breeders. Of course, it gets nasty when the breeder is like an FDI and the grower is like some local grower. It is something were we need WIPO/UPOV as IPR issues become more important in developing countries. I am not trying to say that the growers are clean, the breeders are bad – don't get me wrong. We have a lot of cases of cheating by growers. Of course, some of them are not fully appreciating the effort that goes into the production of some of these varieties and that somebody has to pay for this. But we equally have a lot of malpractices by breeders. The mechanism is what could be done at UPOV but, of course, the implementation has to be at country level. Huge thinking is going on here. There may be a case where a breeder says, "I breed my flowers in a European country, and if there are any taxes, you pay them at your country level, I don't want to be part of that". – Even though taxes are supposed to be paid by the breeder, sometimes you are told as a grower, "No, you observe that. I am operating in an international environment where I would not like to be subject to local taxation". So, this is something you might have to take on as a grower in a particular country. I could go into lots of details from a very practical point of view but despite those growing tensions in some situations, growers and breeders are excellent partners, a grower needs a breeder and a breeder needs a grower. We need to make sure that there is a mechanism that deals with some of those things. It is not just the payment of royalties which is a mechanism as well. It is not just the absolute amount, don't get it wrong. It is not just that there is some 20 million US Dollars being paid as royalties to some research somewhere in Europe from Africa which could be very well spent doing serious research in Africa. That of course is important, but it is also the fact that the mechanisms are not as functional as they should be. Secondly, about the issue of growers being represented at UPOV: I think that it is normal and logical that when you're looking for an entity to deal with matters of international law, obviously the first point to call is the government, which should always be directly involved. But there should be a mechanism at the Government levels of UPOV members which ensures that there is good consultation on IPR issues with national stakeholders. Otherwise you have a disconnection whereby there might be decisions that will not reflect realities between breeders and producers in particular countries. This is sometimes obvious in developing countries with regard to a disconnection between an international negotiating mechanism and your practice on the ground. It is very important that this is addressed. Otherwise you are going to create a mechanism that doesn't actually work but everybody signed on to it, and then the tensions come and, of course, things will go quite wrong.

A.- S. Moephuli: I do not think there is a system that is perfect. I am now referring to the slide about the distribution of plant breeders' rights in South Africa: 60 per cent of them are from outside South Africa. That actually means that the breeders are residing outside South Africa and the research was done outside South Africa. You now have access to those particular varieties in South Africa in order for you to be able to produce a marketable product. But if you are a producer, such as a farmer of a protected variety from outside South Africa, this means you have incurred an input cost on the IP largely to a breeder from another country – an additional cost that should be avoided for lower food prices. You now have a cost that you need to pay to somebody else. Please compare that with a system where the breeder is internal to your country and your costs are localized to your currency. Then you are facing a very different input cost for your competitiveness if you are a commercial farmer, regardless of your farm size. In many instances that tends to be one of the key issues that we face as a developing country, how best to lower your input cost. We are finding that one of the issues arises within the context of having to pay royalty fees to those externals that own the plant breeders' rights. Now you are paying a much higher price than if they were locals, because the US Dollar tends to be higher than the local currencies in most developing countries. The question becomes, what system then would be most appropriate for your needs for food security and for your economic development.

A. – P. Button (UPOV): I would just like to explain that the UPOV system does not establish a specific mechanism for collecting royalties and does not specify the basis on which breeders should authorize the propagation of a protected variety. It is entirely a matter for the breeder and the grower, or whoever else the breeder wishes to license, to arrange mutually agreed terms; both parties have to be content with an arrangement. In different countries, for different crops, there are many different mechanisms. It may be interesting to look at some of those different mechanisms to see if they might provide a good solution. With regard to representation at UPOV of horticultural producers, the International Association of Horticultural Producers (AIPH) has observer status and is able to present the position of horticultural producers. As you have explained, those producers greatly value plant breeders' rights as an important tool for their trade. Of course, there is also the possibility to raise any issues concerning plant variety protection with the UPOV member concerned. However, ultimately, the agreements between breeders and propagators, farmers and producers are a matter for the parties concerned.

Analysis of Opportunities and Challenges in IPR and Agriculture in the Indian Context[1]

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Summary

This paper describes the current scenario of the food and related sectors in India and reviews the state of proprietary technologies and technical products as determined by the free searches for patents and other forms of IPR. It is seen that the number of foreign applicants seeking patents in the area of plant biotechnology is huge when compared to the applications made by the Indians. A number of proprietary technologies have either entered or these are at the verge of entering the Indian scenario. The status of grant of plant variety protection titles and their licensing/cross-licensing shows enormous further scope. A number of agricultural goods have been registered as GI's of India but their commercialization in world market would definitely require effective partnerships and collaboration with interested foreign companies. Trademarks of both Indian and foreign companies enjoy the good will in the Indian market. Further prospects are discussed.

Key Words: Intellectual Property, IPR, Agriculture, Patent, Plant Variety Protection, Geographical Indications.

Introduction

The application of intellectual property rights is aimed at providing knowledge intensive solutions for the complex biological and managerial problems faced by world today in food, health, and environment sectors. Availability of suitable germplasm and appropriate technological tools is critical to meet the agricultural and food production goals. The complementary role and relevance of sectoral players from both public and private sectors is further important to attain such an achievement. This paper aims at discussing the Indian scenario in respect of brief description of the food and agricultural sector, the upcoming knowledge-intensive intellectual property domain particularly patents in plant biotechnology, and future perspective.

Food and Food Processing Sector

India is currently the second largest producer of food in the world; the food industry in the country is valued at US$ 180 billion, and the food processing industry estimated at US$ 70 billion by the Union Ministry of Food Processing is the one of the largest industries. In terms of production, consumption, export and expected growth, India is ranked fifth in the world[i]. The food processing industry employs 1.6 million workers directly. It contributed 6.3 per cent to India's GDP in 2003, had a share of 6 per cent in total industrial production. Value addition of food products is expected to increase to 35 per cent, and fruit and vegetable processing will increase to 25 per cent of total production by 2025. Dairy sector has the highest share of processed food, where 37 per cent of the total produce is processed, of this only 15 per cent is processed by the organized sector. The export of spices and spice-based value added products in 2010-11 was over US$ 1,300, and the Indian non-alcoholic drinks market was estimated at around US$ 4.5 billion in 2008.

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[1] Paper presented in the WIPO Seminar on How the Private and Public Sector Use Intellectual Property to Enhance Agricultural Productivity. World Intellectual Property Organization, Geneva. June 14, 2011. The title is identical to a published paper by the author cited under the references but this is the updated version. The views expressed herein are that of the author and these do not necessarily represent any official views.

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The capacity of agro-terrestrial and aquatic-ecosystems to maintain and increase their productivity, and adapt to changing circumstances, is vital to the world food security. India has rich genetic resources for food and agriculture under both on farm *in situ* and *ex situ* conditions. The country harbors two Vavilovian centres of crop diversity and origin and two of the 18 hot spots of agrobiodiversity; and it has the third largest national gene bank with a long term storage capacity of one million seed germplasm samples (and the current holdings of nearly 0.4 million germplasm samples) of various crops and their wild relatives[ii]. Like in crops, a long history of domestication and development has led to significant diversity of livestock species and their local populations, which also contribute to today's agriculture and food production, and provide options to meet the future challenges, including the climate change, emerging disease threats, new knowledge of human nutritional requirements, fluctuating market conditions or changing societal needs[iii]. Domesticated species of birds, including chickens and ducks, etc., also provide source of food.

The total fish production in India is 6.4 million metric tonnes (3.4 million metric tonnes inland and 3.0 million metric tonnes marine production). The fishery sector contributes about 1.21 per cent of the total GDP and 5.37 per cent of the GDP from agriculture sector and provides employment to 14 million people. The investment opportunities in the Indian food industry are set to shoot up by a huge 42.5 per cent to US$ 181 billion in 2015 and to US$ 318 billion by 2020[i].

India's food retail industry is poised for exponential growth, and is estimated to more than double to US$ 150bn by 2025[iv]. The high growth in food retail is limited by sub-optimal supply chain caused by low investment in the sector, which despite the large consumer basket received only 3.3% out of the gross FDI flows in India between 2000 and 2010. The next growth trajectory for the food industry in India may be possible with fast changing demographics and habits, change in consumption patterns, evolution of innovative food processing capacity, emergence of organized retail, and country-wide popularization of brands that may successfully re-engineer their back end processes and optimize their supply chain management system.

Seed Sector

India ranks 6th in its domestic seed market; estimated at US$ 1,500 million in 2010[v]. The value of seed import in India is estimated to have risen from US$ 32 million in 2008 (US$ 19 million for vegetable seeds and US$ 13 million for seeds of field crops) to US$ 52 million (US$ 37 million for vegetable seeds and US$ 15 million for seeds of field crops) in 2009. The seed export is also estimated to have risen from US$ 25 million in 2008 to US$ 33 million in 2009; out of which the component of field crops seeds has been constant at US$ 16 million in both years but there has been almost double the growth in vegetable seeds export; from US$ 9 million in 2008 to US$ 17 million in 2009. In terms of quantity, the seed import and export in vegetable crops in 2008 and 2009 was 1,540 and 3,870 Metric Tonnes, respectively.

Looking into the overall size of the commercial world seed market which is assessed at US$ 42 billion, and also observing the fact that a sudden jump of more than two-and-a-half times in the world seed trade from over US$ 1,250 million to nearly US$ 3,000 million was seen between 1985-1990 i.e. a period around the Uruguay Round, the progress in commercial seed sector in India has been obviously slow, both in terms of value and time line. Nevertheless, the annual growth rate of 12 per cent in value terms in recent times is encouraging.

The commercial seed market in the country accounts for only 25 per cent of total potential[vi]. The domestic need is inadequately met with the present seed availability at around 150 million tonnes, valuing at US$ 1,500 million. Public sector holds 24 per cent of the seed market; private sector captures 43 percent, and the unorgasnised sector also has its presence in around 33 per cent of the total seed market. Hybrids account for over 40 per cent of seed trade in the commercial seed market, wherein cotton, vegetables, maize are among the largest segments by value, followed by sunflower, sorghum and pearlmillet. However, in terms of volume, rice and wheat together capture over 85 per cent of the seed trade, and rest of the crops other than cereals and millets cover just over 4 per cent of the total seed trade[vii].

Other Agricultural Inputs Sector
To realize the productivity potential of good quality seed, requirement of suitable agricultural tools, farm power and machinery, including laser levelers and seed cum fertilizer drills, fertilizers/biofertilizers, pesticides/biopesticides, combine harvesters and post harvest processing technology has to be duly met. Estimated industry size for fertilizers, agri-equipments and pesticides in India in 2010 was US$ 30 billion, US$ 5,500 million, and US$ 1,500 million, respectively[v]. Marketing in these inputs in India is predominately non-exclusive despite that a number of Indian patents are secured and maintained by few agrochemical giants. The market goodwill of such input products is, at present, ensured by their well known brands (registered or unregistered trade marks) and organized chain of registered retailers. However, the scenario could vary considerably depending upon how the knowledge intensive input product packages are marketed under the exclusive patent regime when patenting in biotechnological products sets its pace in India in future.

IP Compatibility in the Current Scenario
IP protection and technology products, both, impact research and development strategies. Intellectual property (IP) may clearly subsist in various cases of traditional knowledge, discovery, invention, and innovation in agriculture sector but all IP is may not be protectable and worth protecting for exclusive use. The Indian patent legislation, for example, does not recognize IP in a method of agriculture and horticulture[viii] or a mere discovery[ix] as patentable invention. Thus, historically, there has been little interest or progress in the acquisition and the exclusive use of patents in Indian agriculture. However, branding (trade marks in various agricultural input products and produce) and trade secrets (protection of undisclosed information on the parents of hybrid seeds in the market) have been the two predominant forms intellectual property rights (IPR) harnessed in agriculture sector by the country in both domestic and international market.

In relation to branding, for example, the acceptability and product quality of many local Brands like ‘Parle-G’, ‘Maggie’, ‘Top Ramen’, ‘Panchranga’, ‘Lijjat’, ‘Nutrella’, ‘Lal Qila’, ‘Kohinoor’, ‘MDH’, ‘Aahar’, ‘Dhara’, ‘Amul’, etc., is well known in the domestic market and some of their products have presence in the world market as well. Similarly, the international Brands such as ‘Pepsi’, ‘Cargill’, ‘Heinz’, ‘Kellogg’s’, etc., have already naturalized their presence and hold in the food processing sector in India. Brands like ‘McDonald’, ‘Domino’s’, ‘KFC’, ‘SubWay’, ‘Pizza Hut’, ‘Dunkin Donuts’, etc. are quickly spreading in fast food sector. Whereas, ‘Tata’, Reliance’, ‘ITC’, ‘Godrej’, ‘Hariyali Bazar – DCM Shriram’ are well known symbols in the retail marketing segment in the country.

Similarly, with respect to trade secrets, the unique dominance of ‘Coca Cola’ until recently was guarded by its undisclosed information on the product formula. The company recently successfully advertised its product to boost sales; with a traditional knowledge based word ‘Thanda’ to symbolize the beverage with the ‘cold aerated water which will be served to almost every guest in the Indian households in summer’.

The private seed industry in India surged mainly by harnessing the inbred lines of their promising hybrids as trade secrets and generating farmers’ goodwill in the marketing of these hybrids through demonstrations and knowledge products. Recurrent seed replacement by the annual purchases of hybrids by farmers has attracted huge private investments in select crops such as maize, sunflower and many vegetables.

Although seeking patents and plant variety titles, where applicable, is not uncommon in the present day context in India, with both public and private players upcoming to harness the right opportunity, yet their practical application for exclusive marketing and fruitlul co-existence of the seed R&D agencies and companies through licensing and cross-licensing is yet to pick up in routine.

It may also be interesting to observe that India has maintained its world trade in ‘Basmati’ rice without any registration for Geographical Indication. Rather, the geographical appellation of its premium rice is ensured through registered or unregistered marks and the trade in this well established product is also safeguarded as per the civil law recourse for Passing Off and the Law of Torts. Attempt to exclude exports of Basmati rice to USA from India were also discouraged by successfully challenging the Rice Tech's patent on Basmati Rice and Lines. On the other hand, 'Darjeeling' tea is an appropriate example of a successful Indian GI based product in the world market. The 'Darjeeling' logo is also protected as certification trade mark in many countries of Europe, USA, Japan, Canada, Egypt and others[x].

Next Generation Challenges in Agriculture

Primary interests in agriculture include humanitarian cause; these are superimposed by the issues of population, health, environment, socio-economics, Gross Domestic Product and growth. The interests in agriculture are affected by several internal as well as external factors, including the resource availability and management of resources; access to inputs, input delivery and use efficiency; post harvest management, and the sub-sectors catering to the management of produce, for example, packaging, storage and transportation; integration into local and global market, etc. Presently, India in terms of agricultural R&D is among the well-to-do countries; both technologically and bioresource-wise, and the country is evenly poised in respect of the global interdependence for genetic resources and input technology. However, the newer global predictions, such as the climate change, are likely to throw more challenges of unpredictable agricultural productivity and production the world over, including in India.

The challenges of climate change as well as new problems of known commodities require better-coordinated basic and strategic research in frontier areas of agriculture and cutting edge of science. Farmers' empowerment, trade promotion, and enhanced public-private partnerships in R&D, incubation, scaling-up, product development and exploring the markets nationally and internationally. In this respect, the use of IPR tool is important to ensure access to and transfer of new technologies and technical products besides encouraging innovativeness through appropriate incentives and benefit sharing. Recently, Sastry *et al.*, 2011[xi] have illustrated the comparative impacts of the conventional and modern technologies and their implications for food systems. This comparison (Table 1) also hints at the enhanced pace and promise of more solutions being offered by the emerging technologies. Nevertheless, a greater understanding and application of IP management and an early release into the commercial domain of these technologies and technical products for their validation, certification, and scaling up where needed, for enterprising and marketing, will be required to ensure their efficient percolation to the end users.

Table 1: Comparisons among conventional (green revolution) technologies, biotechnology and nanotechnology with respect to their impacts and implications for food systems.

Characteristics	**Green revolution technologies**	**Biotechnology**	**Nanotechnology[a]**
Primary area of focus	Productivity of mainly cereal crops viz. wheat, rice, maize, sorghum	Productivity of all crops, including cereals, fibers, vegetables, fruits, export commodities, and specialty crops	Productivity and management of crops and livestock – crop and livestock improvement, precision agriculture, soil and water management, pest diagnosis/ surveillance, food processing, food safety and packaging
Secondary area of focus	None	Animal and fish products, processed food products	Vaccines, pesticides, fertilizers, water, gene, drug, inputs for remediation of natural resources and other input delivery formulations in plants and animals; nanoarray based gene-technologies for gene expressions in plants and animals under stress conditions; utilization of

Characteristics	**Green revolution technologies**	**Biotechnology**	**Nanotechnology**[a]
			agricultural waste
Applications	Crop input packages; improvement of plant architecture; genetic enhancement through conservative breeding	Tissue culture, micro propagation; transgenic crops/animals; MAS; biotechnology, proteomics	Areas of gene/DNA delivery, expressions, sequencing, therapy, regulation: DNA targeting, extraction, hybridization, fingerprints for DNA; RNA detection, cell probes, cell sorting and bioimaging, single-cell-based assay, tissue engineering, proteomics and nanobiogenomics
Parties in technology development and dissemination	Largely public or quasi-public sector	Substantial private sector involvement – industry concentration	Large public investments, relatively small scale private sector, venture, capital funds
Proprietary considerations	Patents and plant variety protection not important; free flow of Germplasm	Many processes and products patentable and protectable, issues related FTO	High patent activity, increased controls
Capital costs of research	Relatively low	Relatively high	Extremely high; but partnerships can lower costs
Research skills required	Conventional plant breeding and other agricultural sciences	Molecular and cell biology expertise plus conventional plant breeding skills and expertise in other agricultural sciences	New knowledge and skill set in addition to conventional; new workforce to be created
Crops displaced	Traditional varieties and land races replaced by high-yielding varieties/ hybrids	Traditional varieties and land races replaced by high yielding varieties/ transgenic/GM crops	Expected to enhance not displace crops
Access to information and resources	Relatively easy	Restricted due to IPR	Extremely restricted due to broad set of claims; several emerging grey areas in IP jurisprudence
Regulatory system	Not warranted	In place but through continuing opposition; still evolving	Evolving; not in place even at global level
Environment risks	Evidence for several negative effects on natural resources	Mixed conflicting reports	Clear data still not available
Ethical issues	Low to medium	Medium to high	Several suppositions; gray area needing attention
Socioeconomic risks	Gaps in reaching farmers with small holdings	Access to technology products; widening income disparity between small and large farmers; technology divide between	Too early to derive conclusions; technology divide between developed and developing countries

Characteristics	Green revolution technologies	Biotechnology	Nanotechnology[a]
		developed and developing countries	
Influence on society	Helped developing countries to be food – self-sufficient; prosperity in several strata of society	Aim poverty reduction through increased productivity; lower food prices and better nutrition	Expected to influence all levels and bring new paradigms in society
Public acceptance	All countries	Not acceptable in many countries of EU for food; mixed response in Asia	Initial protests by civil society started

[a] Based on indications in early research and projections forecasted.
Source: Sastry *et al*., 2011

IP Compatible Solutions to New Problems or Situations
Agriculture and the trade related aspects of intellectual property rights are now integral to the present day world trade order since the Uruguay Round; but the ‘developed-developing mindset’ to harness both from agriculture and intellectual property rights has deep divide. The main conceptual difference is that the ‘developed’ rightly holds high the personal (private) rights and the economic return in fiscal terms under the IPR regime, the ‘developing’ rather still views it more in socio-economic terms (community’s benefit). In latter case, although monetary return by individual persons is also a goal, its magnitude of scale, both in terms of quantum of production and valuation, is clearly an issue; this being due to lesser investment and institutional capacity of the ‘developing’. However, the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS Agreement) is well built to address various issues related to standards and enforcement once the IPR-compatible mindset is developed over the time.

Here, the relevance of such a mindset may be illustrated from the successful harnessing of inventions in spinning jenny (Hargreaves' Patent in 1770), cotton gin (Eli Whitney’s patent in 1794; validated in 1807), and several applications of James Watt’s patent in 1769 on improved version engine besides the innovative use of the inventions in mechanization of agriculture (plough/seed drill/dig irrigation/drainage channels/threshing) in the Medieval era in Europe. This mindset, and the acceptability of industrial property rights in all fields, successfully brought the industrial revolution of Europe in agriculture too. Similarly, equitable distribution of benefits from commercial proceeds in Geographically Indicated products of Europe (particularly various cheese products, and spirits and wines) to all engaged in the commercial chain from producer to processor to refrigerated store and transport owners to traders, etc., is worth citing an example of a sound IP compatible mindset coupled with well organized chains of co-prospering GI users to the developing counterparts throughout the world. Such collective approach and strength may also be potentially more capable of addressing the spuriousness and infringement issues around global trade of IP protected goods.

The TRIPS Agreement, Article 65, allowed the developing country members a transition period of ten years to take appropriate legislative, policy and administrative measures to allow product patents in all fields of technology, including the food and biotechnology sectors. In the process of transformation, in steps, the Indian patent legislation allowed receiving of patent applications filed by foreign nationals of Member countries under a mail box arrangement. Many of the patent applications filed in India under mail box arrangement as per the Patents (Amendment) Act, 1999 for inventions in the areas of food and chemical (including biochemical and biotechnological) substances, during that period were the national phase entries of the international applications earlier filed elsewhere by the applicants under the Patent Cooperation Treaty (PCT applications). This paved way for a legitimate entry of foreign proprietary technologies in agriculture in the Indian landscape; thereby opening the opportunities for more technology and bio-partnerships, and enhance inter-dependence by setting the examples of effectively harnessing the benefits of intellectual property regime and the world market. Given the huge size and diversity of the agro climates in the country the suitability and potential application of research output from India in other countries and continents under matching agro climatic conditions may obviously have high prospects.

The Upcoming Indian Patent Lanscape in Plant Biotechnology

There is a bounty of foreign proprietary technologies in the field of agricultural biotechnology recently added to the Indian landscape[xii]. It was seen that a simple search in the Indian patent office database[xiii] for 'Transgenic Plant' in the abstract had shown more than 50 granted patents, which were secured by 22 foreign companies, 8 universities and 2 individuals besides 3 Indian institutes and universities. Further to this, search of patents/patent applications was conducted using the free search engine of Big Patents India[xiv], which is developed with the funding support by Ford Foundation. The search showed 407 published applications, which included patent applications for transgenics in plants, animals, fish, birds and microorganisms, and in the field of medicine. The applications were manually sorted and more published applications, not covered therein, and mainly searched from patent office website, were included in the category of plant transgenics. About 73 applications related to the field of medicine and 21 applications were seen for transgenics in animals, fish and birds/poultry. Thus, further analysis was carried out on the remaining 367 patent applications related to transgenics in plants. No statistical accuracy is claimed in this paper, as the aim is just to bring out a preliminary indication of the scenario. The results are interesting indeed.

In the field of plant transgenics, only 24 published patent applications were filed by 11 Indians, including public sector, NGOs, and private seed companies. The International Centre on Genetic Engineering and Biotecnology located in India and the seed company MAHYCO, a partner of Monsanto, have filed highest number (5 each) of these applications. On the other hand, a large number of (82) foreign applicants including 4 MNCs were seen to have filed over 15 published applications each (the highest being 28 applications of Monsanto), 6 MNCs had 5-10 published applications each, and 5 MNCs and 8 foreign universities/research institutions had 3-4 published applications each. Further, 33 foreign universities and research institutes, and 34 other foreign companies showed their interest in entering the Indian IP domain in plant biotechnology by at least one published national phase application to each of their credit. Table 2 shows the number of patent applications and list of applicants from India and abroad in the field of plant transgenics.

Table 2: Patent Applicants from India and Abroad in the field of plant transgenics

Sr. No.	**Category**	**Applicants**	
		Number	**List**
	Direct Filing - Indian Applications		
1.	Public Organizations	4	ICAR, CSIR, DRDO, ICMR
2.	Institutes/ Universities	4	IISc, Bose Institute, DU, GBPUA&T,
3.	NGOs/International Centres	2	MSSRF, ICGEB
4.	Seed Companies	2	MAHYCO, J.K.Agrigenetics Ltd.
	PCT National Phase Applications		
5.	MNCs having > 15 published applications	4	Monsanto Technology LLC, Crop Design N.V., BASF Plant Science GmbH, Syngenta Participations AG,
6.	MNCs having 5-10 published applications	6	Meristem Therapeutics, Asgrow Seed Company, Ceres Inc., Genesis Research and Development Corporation Ltd New Zealand, Novartis AG, Pioneer Hybrid Int. Inc.,
7.	MNCs having 3-4 published applications	5	Aventis Crop Science GmbH, Bayer Bio Science N.V., Planttec Biotechnologie GmbH, Zeneca Ltd England, Dow

Sr. No.	Category	Applicants	
		Number	List
			Agrosciences LLC,
8.	Foreign universities/ Research Institutes having 3-4 published applications	8	Cornell Res. Foundation, Auburn University, Univ. of Central Florida, Boyce Thompson Institute For Plant Research, USA, CSIRO, Institute Fur Pflanzen Genetik, Michigan State Univ., Scripps Research Institute, USA
9.	MNCs having 2 published applications	10	Bioceres S.A., Argentina, Calgene L.L.C.,USA, E I Du Pont, USA, Ecogen Inc., Genoclipp Biotechnology B.V., Keygene N.V., Netherlands, MPB Cologne GmbH, Nippon Paper Industries Co. Ltd., Performance Plants, Inc., Renessen LLC,
10.	Foreign universities/ Research Institutes having 2 published applications	7	National Research Council of Canada, Texas Tech. Univ., Univ. of Glasgow, Univ. of Central Florida, Univ. of Chicago, Univ. of Nebraska, Univ. of Singapore,
11.	MNCs/Foreign Companies having 1 published application	24	Agrivida Inc., Ajinomoto Co Inc, Arcadia Biosciences, Inc., Avestha Gengraine Tech. Pvt Ltd., Benitec Australia Ltd., Abbott Laboratories, Chromagenics B.V., Netherlands, Cobento Biotech Denmark, Cotton Incorporated USA, Fraunhofer Germany, Greenovation GmbH Germany, Intrexon Corp., Japan Tobacco Inc., Kweek En Researchbedrijf Agrico B.V., Leif Bulow, LTA Resource Management, USA, Maxygen, Inc., Nongwoobio, Korea, Novo Nordisk, Protalix Ltd, Qualcomm Inc., Sembiosys Genetics Inc., Senesco Technologies Inc., Targeted Growth, Inc, Vidius Inc.,
12.	Foreign Research Institutes having 1 published application	9	PRI Netherlands, Chinese Academy of Sciences, National Institute of Agrobiological Sciences, Japan, EMBRAPA Brazil, Alberta Research Council Inc., Institute of Molecular Agrobiology, Singapore, Kitasato Institute, Research & Development Institute, Inc., SNU R&DB Foundation, Korea,
13.	Foreign universities/ having 1 published application	9	Freie Univ. Berlin, North Carolina State University, Queen's Univ., Kingston, Universidad Politecnica De Valencia, Universidad Publica De Navarra , Spain, Univ. of Arizona, Univ. of California, Univ. of Cape Town, Univ. of York,

Source: Compiled

Further analysis was conducted to find out the fields of technology in which these patent applications were made, the food crops involved, the genes or other features of the technology disclosed/claimed, and the corresponding lists of applicants (Table3).

Table 3: Number of applications and applicants in various fields of technologies and major disclosures

Sr. No.	Field	Number of Applications (Applicants)	Genes/ Crops/ Other features	Applicant(s) (No. of Applications)
1.	Food Crops	33 (17)	Rice, maize, sorghum, chickpea, pea, soybean, okra, tomato, sunflower	Aventis (2), avestha (1), BASF (2), CSIRO (1), G.B.Pant Univ. (1), ICAR (1), ICGEB (1), MAHYCO (3), Meristem Therapeutics (2), Monsanto (7), Novartis (1), Pioneer (1), Syngenta

Sr. No.	**Field**	**Number of Applications (Applicants)**	**Genes/ Crops/ Other features**	**Applicant(s) (No. of Applications)**
				(3), Univ. of Singapore (2), Univ. of Arizona (1), IISc. (1), Individuals (3)
2.	Transgenic Event	7 (4)	PE-7(Rice), PE-4 (Rice), MON89034 (Maize), DP-098140-6 (Maize), MIR I62 (Maize), Elite/ undescript (Okra), Detection Method	MAHYCO (3+1), Monsanto (1), Pioneer (1), Syngenta (1)
3.	Yield Increase	13 (4)	HSRP, SHSRP, ACCDP, MTP, ste20-like expression, RNA-editing to generate male sterile lines	Crop Design (7), BASF (4), Avestha (1), Research & Development Institute Inc. (1)
4.	Drought Tolerance	5 (4)	via a plastid genome, nucleotide sequences, encoded polypeptides, non-descript,	Ceres (2), PRI B.V. (1), Univ. California (1), Univ. Central Florida/Univ. Auburn (1)
5.	Growth Rate and Biomass	1 (1)	nucleotide sequences/ polypeptides,	Ceres (1)
6.	Agronomic and nutritional value	1 (1)	method to improve	Greenovation (1)
7.	Disease/stress resistance	20 (13)	Soybean rust, Squash Mosaic Virus, PI TA gene, resistance against fungi, Commelina Yellow Mottel Virus, Cassava Vein Mosaic Virus, insect resistance to monocot, oxidative stress management, RNA1 technique, Cestrum Yellow Leaf Curling Virus, Bacterial blight of rice, multiple resistance, other non-descript	Agrosaw (5), Cornell Univ. (2), BASF (1), E. I. Du Pont (2), Fraunhofer (1), MSSRF (2), Meristem (1), Novartis (1), Chinese Academy of Sciences (1), Syngenta (2), Univ. of Singapore (1), Scripps Res. Institute (1), Individuals (2)

Source: Compiled

Accordingly, proprietary transgenic technology is poised to enter/has entered in India in various field crops (Rice, maize, sorghum, chickpea, pea, soybean, okra, tomato, and sunflower) through over a dozen foreign applicants. Patents have been granted and published applications are seen in a number of transgenic events in food crops although no food crop transgenic has been released so far in the country. Patent applications for yield increase trait disclosed genes like HSRP, SHSRP, ACCDP, and MTP; ste20-like expression, and RNA-editing to generate male sterile lines for production of hybrids. Patent protection of drought tolerance technology via a plastid genome, or nucleotide sequences, encoded polypeptides, and other claims has been indicated. Nucleotide sequences/ polypeptides for increase in growth rate and biomass and method to improve agronomic and nutritional value with the use of molecular tools has been disclosed. Also molecular tools for imparting plant resistance to soybean rust, squash mosaic virus, fungi, Commelina yellow mottel virus, cassava vein mosaic virus, cestrum yellow leaf curling virus, bacterial blight of rice, and multiple resistance; and insect resistance to monocot plants, oxidative stress management, RNA1 technique, PiTA gene etc. are disclosed as being the potential tools for exclusive use in Indian agriculture.

Although the national agricultural research system in India is also on the patent map to some extent, the public research system in the country is now faced with many challenges, given the ‘competitiveness’ as the buzz word under the global IPR domain, and the broad ‘directive principles of state policy’ to cater to the generic needs of the Indian farmer. The challenge is to re-prioritize and undertake research in those key areas that may yield technology profile specifically suited to Indian situations, and complement the international proprietary technologies protected in the country. At the same time, there is opportunity to partner with the private sector and create win-win situations in both domestic and world markets through judicious licensing, cross-licensing, patent pools etc.

Kochhar (2011)[xii] has attempted to also present the Indian proprietary agricultural technology profile but explained that unlike the upcoming proprietary foreign technology in agriculture in India, in the recent times, the magnitude of scale of the commercialization of Indian patented technologies is rather low to missing. This requires further insight and efforts towards patent landscaping, IP audit, valuation and negotiations for commercialization to be made within the country. The author also urged to focus on *niche* having the indigenous R&D strength and build effective partnerships with multinationals where possible to help the world, particularly the developing world, in meeting their present and future agriculture technology needs.

Plant Variety Protection

Protection to plant varieties in India is granted under the Protection of Plant Varieties and Farmers’ Rights (PPV&FR) Act, 2001. Patents are not granted for plants in whole or any part thereof including seeds, varieties and species and essentially biological processes for production or propagation of plants under section 3(j) of the Patents Act, 1970. In the absence of patents available on plants or plant varieties in India, the protection of plant varieties assumes greater significance. However, the number of titles granted to plant varieties (219) so far in India is not substantial. Most of these are granted to extant varieties (217) of food crops[xv]. Private seed companies are quite active in seeking plant variety titles in their new varieties of notified crops/genera[xii]. However, it may be critically seen that the registered and protected extant varieties, for which titles have been already issued, have not so far been subject to any licensing and cross-licensing for the purpose of commerce and other uses.

The Indian plant variety legislation had provided a fairly long transition period for the registration and protection of the existing varietal products. Some titles have also been granted but the lack of licensing/cross-licensing in the protected varieties jeopardizes their use in commerce and further R&D (for commercial purposes), particularly the development of Essentially Derived Varieties for exclusive use. Interestingly, copies of the germplasm of the registered extant varieties are already available public domain, including the international gene banks and nurseries, which are being freely used by all sectors and no infringement issues are raised! It was opined that an appropriate corrective measure at this stage may include voluntary or cross-licensing by the owner of the plant variety title or a compulsory license by the PPV&FR Authority.

Geographical Indications

In India GI registration of agricultural goods has progressed well[xvi] as shown in Table 4. Out of 151 GIs registered so far in India, 39 are agricultural goods. The range of protected agricultural commodities includes rice (5); several fruits – mango (5), banana (4); grapes, strawberry, guava, orange, pomello, pineapple and coconut (1 each); tea and coffee (2 each); spices (6), and others (8).

Table 4: Registration details of G.I. applications in India (2003 – 12th May 2011)

Commodity	S. No.	Geographical Indication	State
Rice	1.	Navara Rice	Kerala
	2.	Palakkadan Matta Rice	Kerala
	3.	Pokkali Rice	Kerala
	4.	Wayanad Jeerakasala Rice	Kerala
	5.	Wayanad Gandhakasala Rice	Kerala
Mango	6.	Laxman Bhog Mango	West Bengal
	7.	Khirsapati (Himsagar) Mango	West Bengal
	8.	Fazli Mango grown in the district of Malda	West Bengal
	9.	Appemidi Mango	Karnataka
	10.	Mango Malihabadi Dusseheri	Uttar Pradesh
Banana	11.	Nanjanagud Banana	Karnataka
	12.	Virupakshi Hill Banana	Tamil Nadu
	13.	Sirumalai Hill Banana	Tamil Nadu
	14.	Kamalapur Red Banana	Karnataka
Grapes	15.	Nashik Grapes	Maharashtra
Strawberry	16.	Mahabaleshwar Strawberry	Maharashtra
Guava	17.	Allahabad Surkha [Guava]	Uttar Pradesh
Orange	18.	Coorg Orange	Karnataka
Pomello	19.	Devanahalli Pomello	Karnataka
Pineapple	20.	Vazhakulam Pineapple	Kerala
Coconut	21.	Eathomozhy Tall Coconut	Tamil Nadu
Tea	22.	Darjeeling Tea (word & logo)	West Bengal
	23.	Kangra Tea	Himachal Pradesh
Coffee	24.	Monsooned Malabar Arabica Coffee	Karnataka
	25.	Monsooned Malabar Robusta Coffee	Karnataka
Spices	26.	Malabar Pepper	Kerala
	27.	Spices – Alleppey Green Cardamom	Kerala
	28.	Coorg Green Cardamom	Karnataka
	29.	Naga Mircha	Nagaland
	30.	Guntur Sannam Chilli	Andhra Pradesh
	31.	Byadagi Chilli	Karnataka
Betel Leaf	32.	Mysore Betel leaf	Karnataka
Jasmine	33.	Mysore Jasmine	Karnataka
	34.	Udupi Jasmine	Karnataka
	35.	Hadagali Jasmine	Karnataka
Fries	36.	Bikaneri Bhujia	Rajasthan
Jaggery	37.	Central Travancore Jaggery	Kerala
Logo	38.	Nilgiri (Orthodox) Logo	Tamil Nadu
	39.	Assam (Orthodox) Logo	Assam

There may be hardly any experience gained so far in promoting this IP in the world market. However, given the diversity and uniqueness of these ethnic products, coupled with the liking for organic foods in Europe recently, there is scope for the registered GI owners to explore partners for international trade of some of these GIs.

Discussion

Plant breeding is nearing ‘three centurion’ age; dating back from the time when Thomas Fairchild produced first artificial plant hybrid between carnation x sweet william, in England in 1717. At over 250 years old, Vilmorin is considered to be the oldest seed company in the world. It was founded as a plant and seed boutique in France in 1742 by the chief seed supplier and botanist to King Louis XV.

For over two and a half centuries, considerable productivity enhancements have been made by plant breeding. The latter, in turn, has itself evolved from being empirical art and science to a more systematic and scientific conventional approach, which further expanded to modern day science by including into its fold newer scientific developments in designs of experiments to minimise error due to environmental variance, partitioning of additive, dominance and epistatic effects, applied genetics, population genetics, quantitative genetics, mutation breeding, biotechnology and transgenics, etc.

Superior genetics and technologies with excellent research and development establishments have resulted in many fold increase in productivity potential of major crops, and increased the prospects of their cultivation in various crop seasons and in different agro-ecologies. In the present day context, molecular plant breeding is getting increasingly dependent on proprietary tools and equipment. The possibility of grant of broad patents causes additional concerns and poses further difficulties in IP management of relevant incremental inventions[xvii,xviii].

Similarly, abundant plant treasure on earth planet was, until the early 1990s, freely available to all for its direct and indirect uses but the change of genetic resource regime from being ‘free’ to ‘facilitated’ access, is being increasingly linked to equitable benefit sharing. In view of these dilemma, the developing countries, including India, continue to be in the spate of learning process in terms of harnessing their IP despite the fact that the transition period required under the TRIPS Agreement was already over before 2005, and the country has set in place its new, TRIPS-compatible legislative regime covering various forms of IPR.

The National Agricultural Research System (NARS), led by the Indian Council of Agricultural Research (ICAR)[xix] has taken a series of steps to streamline organizational policy and develop guidelines[xx] for the IP management and technology transfer/commercialization in the system. The Council has provided intensive in-house and outdoor training opportunities to scientists and other staff engaged in the IP management and commercialization pursuits at its various institutes and agricultural universities. Further, the National Agricultural Innovation Project (NAIP)[xxi] launched by ICAR with the World Bank funding support has invested hugely in terms of capacity building and human resource development in the NARS as well as among the grantee consortia, having partners from all sectors, through various foreign and national trainings. One of the four NAIP components is particularly dedicated to the basic and strategic research in frontier areas of agricultural sciences, and this has contributed significantly, besides in capacity building and HRD, in terms of submitting isolated and characterized genes and promoters in various crops and animals to the GenBank, making quality publications in high impact scientific journals, validation and registration of products developed/ reference materials generated, and the development of novel tools/ protocols/ methodologies for research in frontier areas. Such pool of new information and products is worth attracting further partnerships with the private sector for validation, scaling up and/or commercialization purposes.

ICAR/NAIP have gradually steered the research system towards innovation, from mere technology development; and expect to encourage further innovativeness as the learning experience in the commercial domain starts bringing in the dividends. The Council is increasingly engaging with the private sector to help create some win-win situations which may then be used as models to expand the horizon.

The inhibitions at the initial steps in the learning process may be still prevailing in the same old way but the horizon appears to be crimson and clear. In fact, the present era is demanding for an academic build up of the IPR subject so that the superfluous and redundant thinking and practices are shed over the time and duly streamlined, simple and effective theories, practices and bridging theories, and updated text books are developed and published in the short to medium term for use by the young students of the present and next generations. With that much being achieved, the future of IP-led pursuits remains poised and well rewarding to the world community.

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Transcript of the presentation on “Analysis of Opportunities and Challenges in Intellectual Property Rights and Agriculture in the Indian Context” made by Sudhir Kochhar at the Seminar on ‘How the Private and the Public Sectors Use Intellectual Property to Enhance Agricultural Productivity’ held at WIPO, Geneva on 14 June 2011

Good Afternoon!

Slide-1
The stage has already been set with the various presentations made in the morning session. The two sides of the antique one rupee coin of Holkar dynasty dating back to 1843 included in the title slide shows sun (energy) on one side and vegetation (life) on the other side, which may fit well in the context of today’s seminar, and is also an appreciation of the traditional knowledge.

Slide-2
I will be making my presentation in four parts: (i) IPR and agriculture: (ii) Opportunities and challenges in Indian agriculture; (iii) IPR and Indian agriculture; and, (iv) the way forward.

IPR and agriculture
Slide-3
Let me begin with paying tributes to them who have contributed to the conservation of genetic resources for sustainable use as well as the green revolution; and, also to them who mattered in the development of intellectual property rights law in agriculture; Luther Burbank was instrumental in the enactment of the Plant Patents Act of the United States in 1930; Vavilov was instrumental in setting the process of collection and conservation; Borlaug was instrumental in bringing in the green revolution, along with Swaminathan, the World Food Laureate; and, Longping is the father of the hybrid rice.

Slide-4
Application of IPR aims at providing knowledge intensive solutions; whether in the area of the biological or evolutionary challenges or the managerial challenges in the food, health or environmental sectors which greatly affect, and will continue to affect, the human race. One broader concern is that it is the inefficient and ineffective information and knowledge flow that may severely constrain the development in food and agriculture.

Slide-5
The world trade regime presently aims to provide a level playing field in trade related IPR; attempts to address other related global issues, and also harmonize with other international institutional mechanisms.

Slide-6
On the basis various important events that occurred in the area of intellectual property since the UPOV 1961, there has been a stronger advocacy for the IPRs. Access issues came up as a side effect of these developments, and some of these issues are being already addressed under the ITPGR, as presented in the morning session. A point of attention is that in the name of these new developments, a lot and lot is being talked of and invested in training and capacity building. Sometimes, it may be wondered that the amount of money that is being spent in the name of these trainings; whether this is really helpful? Because, what one requires as plant breeder is that more money should be earmarked actually in the operational costs. When we have to do some basic and strategic research, we just count upon externally funded projects, in

which funding is more defined in the salary of contractual staff and other major heads; but, we sometimes forget to give due importance to earmark funds under the head where core money is actually required. For that purpose, having duly realized the importance of IPR, given due regards to the interested donors, we really need to see more realistically in this direction as to how we have to convince them to give more funds for the operational costs.

Slide-7
And then something about the lawful respect to the law of intellectual property rights. It is not a natural right, we all know about it; it's a grant. And, the grant too in lieu of some specific disclosure in a prescribed manner in a particular jurisdiction for a particular term period. Having known all these things, the mindset entirely depends on many things; the way we interpret the things, the way we want to perceive the things, and the way we want to respond to the things. We may also see that the basic difference between the common law jurisprudence area and the civil law jurisprudence area in the world itself is not less a hectic problem that we want to bring in more problems by saying that the intellectual property rights area is not well understood. Well, it is just an offshoot of the civil law to give speedy recourse to the grants; and, then to leave it to the title-holders to decide upon themselves as to what will be their relationships with other parties in the business terms.

Slide-8
This (farmers' rights) is another offshoot area that was brought to light under the regime of the international undertaking on plant genetic resources through the FAO Council resolutions 4/89 and 5/89. We may have been talking a lot about it but anywhere in the world, farmers at the grassroot level may not even be made adequately aware about it or have been actually recognized for their work that they have been doing in the real sense of this interpretation. Thus, when we have to talk of the IPR or the access and benefit areas simultaneously, we really need to be more focused than losing the track or sight of our goal, particularly in the context of the climate change, the burgeoning population, and the increasing demand for food.

Slide-9
Opportunities and challenges in Indian agriculture

Slide-10
A slide mentioned in the morning session that India may not be much affected by the current food shortages. Well, India will also be affected, some way or the other. But, it is the global interdependence that is the foremost realization of India, and the country adheres to that. It is almost 50:50 basis in terms of genetic resources the country has given to or acquired from anywhere in the world. And, then there are different countries or continents in the world, which have different proportions of interdependence.

Slide-11
In terms of operational holdings, the actual constraint is that when the land size is just an acre for more than 62 per cent of the national population, then how to really handle the core agriculture scenario. Custom hiring of big machinery could be a relevant answer but then cooperatives have to be there to make this preposition really effective. It is the will of the people in a democracy on the basis of which the relevant policies of the government may work or not. However, there has to be some degree of seriousness in this context if we have to see the future of the world safe in terms of food production and availability in different parts.

Slide-12

In terms of gross capital formation in agriculture, the private sector is increasingly coming forward, contributing about 10 per cent; whereas public sector contribution is almost static, from 6-7 per cent.

Slides-13-14

Despite all the pressures on the conventional technologies, these technologies do not wash out. It is clear from the increases in both national average productivity and the productivity of new varieties of an individual crop, say wheat. Wherever a variety with lower productivity potential than the checks was chosen, this was specifically done for the variety having known genes of resistance to the prevailing races of rust to combat the disease. As a matter of fact, the biotechnology is also likely to become an additional tool of plant breeding only in the days to come. That is where we have to somehow adopt biotechnology for as many numbers of crops as possible or feasible despite all the types of apprehensions that we have around us.

Slide-15

The size of the food industry in India is big, the food processing industry is big, and it is estimated to expand by two times in a next dozen odd years. But, at the same time, the supply chain is sub-optimal, the investment is low, the share of foreign direct investment in the sector is low. The country and the players may not have much to be bothered about at this stage but there has to be a definite march in the positive direction so as to be able to address the future scenario.

Slides-16-17

With US$ 1500 million domestic seed market albeit having less that 1 per cent share of the global seed market, India is still at the joint fifth position in the global seed trade. However, the size and diversity of the agroclimatic conditions of the country, the prospects in this area are bright. Particularly, in the vegetable seeds, there has been a substantial jump both in terms of seed export and seed import in the recent past. As observed earlier, the interdependence of the country in agriculture with the rest of the world is evenly poised.

Slide-18

The public research system has been contributing, and also contributing to the extent of fostering the private sector. In the very beginning, it may be seen that the small seed companies, particularly in vegetable and ornamentals seeds, have come up in India in the 1950s. First maize hybrid was released in 1961 as a result of the establishment of the first All India Coordinated Research Project in Maize in 1957. The first hybrid in cotton and also the first hybrid in grain pearl millet were released in 1970s. A new seed policy was brought in the 1980s, which gave a leeway to the private sector to share the public sector produced new seeds as breeder seed for the production of their foundation seeds and commercial seeds in the seed chain. The success of the cotton transgenics recently shows the will of the country to move in this direction. No doubt, there were initial hassles, and initial misunderstandings, on the part of them who cannot understand the area of IPR that clearly. In this era, the new generation of varietal products is often not related to the genetic productivity potential of these new products; but, it is more based on their better marketing strategy. For example, the wheat variety PBW-343 covered around 8 million hectares area in the Indo-Gangetic Plains; and, it was a collaborative effort of the CGAIR system and the ICAR. Similar is the case of the rice hybrid PRH-10. It did not receive much attention under the All India Coordinated Rice Improvement programme but then in a participatory mode; by licensing to the private sector, it covered more than 50 thousand hectatres area. A concern, in this era, is that a number of materials available in the pipeline are also likely to be used for commercial sales.

Under the All India Coordinated programmes, after selecting top 2-3 elite materials which performed better than the checks, the rest were being discarded. But in the present era a number of hybrids simultaneously available with the sector, may be commercialized in the name of common performing varieties. For example, at present more than 90 hybrids in cotton transgenics may be simultaneously available in the market.

Slide-19
Of course, the private sector in India also acknowledges to an extent that public sector has made contributions to their development. And, it may continue to be the case, in a two-way process.

Slide-20
Just like the seed sector, there is a lot of potential in the other agriculture sub-sectors as well. The pesticides sub-sector is as big as the seed sector; the agriculture equipment sector is more than 3.5 times big and the fertilizers sector is huge (more than 200 times big). Similarly, the biofertilizers, biopesticides and other sub-sectors have a significant presence. The market is there, the IP will be important in its progress; and, the IP will also matter in the transactions among parties.

Slide-21
The delivery mechanisms have changed; the private extension has come a big way.

Slide-22
Of course, the public sector has contributed modestly to these developments in the country.

Slide-23
IPR and Indian agriculture

Slide-24
In India, the best contribution that has been made very recently is that if you visit the patent office web site, you will have searchable data on the Indian patents granted and the published applications. This is something very significant that gives you an idea about what is happening. If you have a lateral window to enter to look out for the partners with whom you have to interact, it becomes easier to shortlist and approach them now; than to look for the desired information from government or the public sector in the first place. There is a long list of what are not patentable inventions in India. There are many of these which are covered under the permissible exceptions under Article 27, particularly 27.2 and 27.3(b) of the TRIPS Agreement. Now, let’s consider, what may be said only for the sake of saying, that methods of agriculture and horticulture are still not patentable in India. Well, it is not that one is not able to get patents on the processes related to agriculture and horticulture if these are patentable inventions. In case of IPR, what matters more is the way in which you construe your patent document, and the way you can get your claims out of it. Thus, what this exception aims at is to appease the small farmers at the base by intending that law is not touching the ways they perform their agriculture or horticultural operations. But, a clearer point is that something that deserves to be patented shall be granted a patent.

Slide-25
Regarding meeting the sufficiency of disclosure, one may submit a sample of the relevant biological material at IMTECH, Chandigarh or any of the 20 notified repositories i.e. International Depository Authority, anywhere in the world. And, of course the disclosure of

the source of the biological material or the traditional knowledge used in invention is mandatory.

Slide-26

In terms of plant variety protection, there is something unique. We have an Act that also covers many things other than the grant of plant breeder's right. Particularly, there is provision for the registration of extant varieties of the notified genera/crops up to three years after the notification. There is a series of farmers' right wherein farmer can be recognized as a cultivator, conserver or also a breeder. A farmer can also register his variety for protection if it meets the criteria for protection and, of course, such criteria for the protection of farmers' varieties will also be softer than the criteria for the protection of standard varieties. No to genetic use restriction technology (GURT) is something very unique. All applicants have to file an affidavit of the dimension of INR 100 stating that the candidate variety does not having any GURT. There is provision of three types of benefit sharing mechanisms under this Act. One is that the Authority and the Registry may take a pro-active consideration based on the parentage given in the questionnaire (specifications) of the variety that has been granted title, and fix a benefit sharing amount. Such amount shall however be deposited to the National Fund; it will not go to the individual breeder on the other side. The compensation for underperformance clause aims at safeguarding the farmers from the risk of adopting the protected varieties. Let us suppose, for example, that a perennial crop has been introduced, or a nursery has been introduced and it has been planted on a sizeable number of hectares; and it does not give appropriate economic yield at the end of the 4th or 5th year. There will be huge loss to farmers unless compensation is ensured. Thus the point is that the value for cultivation and use of the protected varieties must be ascertained and the onus for this is on the breeder. Claim of community right is sort of realization of the farmers' right, i.e. the appreciation of farmers who have conserved some genetic diversity of actual or potential value for use in the breeding programmes. In practice, no monetary or non-monetary compensation has been given; and just a memento or a certificate has been given. However, at least a process has been started that since it has been so much talked of, some compensation or appreciation should be given.

Slides-27-28

The most crucial part is that whether we close or open our eyes, the reality is that something that is allowed under the law will happen. No society can stop it, till the case has to reach the court, till the judges have to take cognizance, till there is adjudication. We had agreed for the mail box arrangement of receiving the patent application. Between the years 1999 to 2004, a sizeable number of patent applicants had been filed, which were actually to be subject to examination only after the product patent regime was in place i.e. 1.1.2005. And, after 2005 also, patent applications are filed regularly. A random search on the patent applications filed in 'agriculture and transgenics' showed some 400 applications. Out of these, less than 90 each were in the fields of pharmaceuticals and animal transgenics. Rest of these were in plant transgenics field. The analysis shows that there are a number of novel and proprietary technologies which have been brought about in agriculture and food crops. For example, there are four applicants with seven applications on transgenic events in crops. At present, only transgenic cotton is there as a commercial crop in the country; but then, with these published applications in rice, maize, okra, etc., the ownerships have been already established. This means that the moment it will be declared that any of these transgenic crops is released for commercial purpose, the players are already ready for the race. Thus, the beauty of IPR is that we have to be well prepared in advance, without making any hue and cry whatsoever, for enterprising once the legislative means and procedures have been established. The published applications, mostly the PCT applications entered in the national phase in the country also show the genes and other technological tools over which the patent claims are made, i.e., over which the proprietary exclusions are likely to occur in near future. There is clearly a second line of proprietary technologies being built on which the enterprises can play. Thus, the past thinking in relation to India being possessive, i.e., with respect to the opposition of basmati patent in USA, is to be undone. One has to bear with the facts that there are so many patents (published applications) in modern technology; which means there may be lot of interplay of the players in these fields, which the national laws clearly allow as well. For the time being, it is being said that India will not be affected by the food shortages; but the possibility is that by the time food deficiency also become visible here, some policies, some rules, some experiences will be surely in place along with some more favourable mindset to address the IPR scenario.

Slide-29
It may be added that the number of foreign companies, foreign institutions, universities and public research systems that have shown interest in India, and as applicants have filed their patent applications, is huge. This is both, interesting and challenging.

Slide-30
In the area of animal vaccines, so far the major player in India, in terms of R&D, production and certification of animal and poultry vaccines has been the Indian Council of Agricultural Research and its institutes, particularly the Indian Veterinary Research Institute. However, the proprietary influx of animal vaccines is also likely to be significant. In the past 2-3 years, Russia, China and Japan in the field of animal vaccines and Russia also in the field of animal diagnostics have become significantly visible on the patent map.USA, and few other players through PCT applications have figured in the field of diagnostics but not the vaccines. It appears an interesting strategic move since vaccines may also be coverable well within a patent on diagnostics.

Slide-31
In plant varieties, about 2200 odd applications have been filed; out of which about ten per cent have been granted titles. Private sector also has some titles to their credit; but in terms of licensing and cross-licensing arrangements, there is not much experience so far.

Slide-32
The developing countries always wish to talk of the GI protection parallel to the special protection that some European products enjoy. This is peculiar. The number of registered GIs in India for agricultural products like spices, rice, mango, banana, jasmine, tea, coffee, and so many other products is increasing. But, not a single, agricultural GI product from India, except Darjeeling Tea, is there in the world market. This also means that a lot of possibility exists to share experience, look towards the global players who are interested in these products, standardize the production of those products in India, get the certification done and then export those products. Basically, one cannot get the GI registered anywhere else unless and until one has the registered GI in one’s own country, and that is where it has been already got done.

Slide-33
In context of the changing nature of the research and innovation providers, it is very clear that the private sector is coming in a big way. The trade promoters and traders are also making effective interventions with their knowledge packets. Because of the mobile telephony and the

internet, there is more opportunity before them to gather and disseminate information to farmers.

Slide-34

The Indian Council of Agricultural Research, as the organizational arrangement, has developed a set of key policy elements and guidelines for its IP management and technology commercialization/transfer. The foremost key policy element is that the commercial ethos has to be brought into, for the technology transfer in agriculture. It does not mean one has to commercialize everything. Point is that anything that is protectable and worth protecting must be got protected in the first instance; and, then it may be decided whether it has to be transferred through commercial mode or if there is any public necessity then one may make different arrangements for that; for example, it could be sort of compulsory licensing. This does not mean not to give profit to breeder of patentee; rather, a reasonable share of the profit has to go to them as well. This is all about IP in the food sector that we need to talk further.

Slide-35

Some ICAR technologies have already been commercialized, although not a big number or size. In Bt detection kit in cotton, the ICAR institute has done some INR 60 million worth of business; and, in the Bt based product, the technology has been licensed to over 20 companies in three states so that this biopesticide is available to a large number of farmers.

Slide-36

Through the basic and strategic research component of the national agricultural innovation project, a plant virus detection kit has been commercialized for the first time. It is originally produced for detection of Groundnut Bud Necrosis Virus; but it is also found effective against viruses of many other vegetable crops. A first buffalo calf has been produced from the somatic cell of buffalo. And, a few kits and sensor based technologies have been developed for the detection of adulterants or contamination in milk.

Slide-37

The way forward

Slide-38

The first and foremost way forward would be to strengthen the collaborative, public and private, R&D. ICAR is organizing Industry meets in collaboration with the private sector. Some of the considerations in the R&D collaborations would be to develop joint intellectual property management plans, pools of proprietary and non-proprietary technologies, research tools and genetic resources, preferential and cross-licensing, clearing house mechanism; foster incubators and start-ups, and to try to create win-win situations in food production and agri-business,

Slides-39-40

There is need to incentivize building up new genetic diversity for future use. We generally consider breeder developed diversity as being important for selection of new products; but, it is also a fact that the cryptic diversity is evolved in the field conditions only. If the evolution of such cryptic diversity was seen under conventional farming, it is bound to be there under mechanized farming as well. The purpose is to have a more sharpened breeder's eye and then have some arrangements for the protection and pooling of that particular IP for further use. Thus, the cryptic variation is always important because it would be naturally harboring sort of endurance to the climate or the farming situation that is changing. In addition to the disclosure and management of IP, innovating suitable out-of-the-box arrangements for access and benefit sharing would also be important. However, whatever has been done so far is just the tip of the iceberg, and a lot more has still to be done.

Slide-41

Ultimately, it is important to develop and promote the academic part of IPR, particularly IP related to plants. It may be observed, in this context, that the field of plant breeding has evolved in the past 70-80 years with the inclusion and refinement of many sub-fields like biometrical genetics, population, genetics, designs of experiment to minimize the experimental error, partitioning of additive, non-additive and epistatic gene action, mutation breeding etc., and thereby the development of more breeding products. Here also, in the IPR era, if we become more focused and foresighted, we shall be able to bring something positive for our future generations.

Thank you.

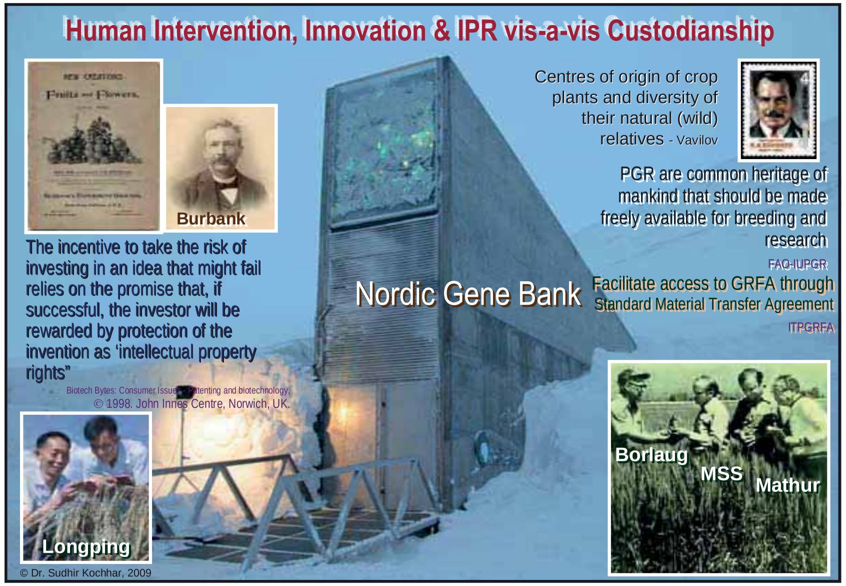
Slide-42

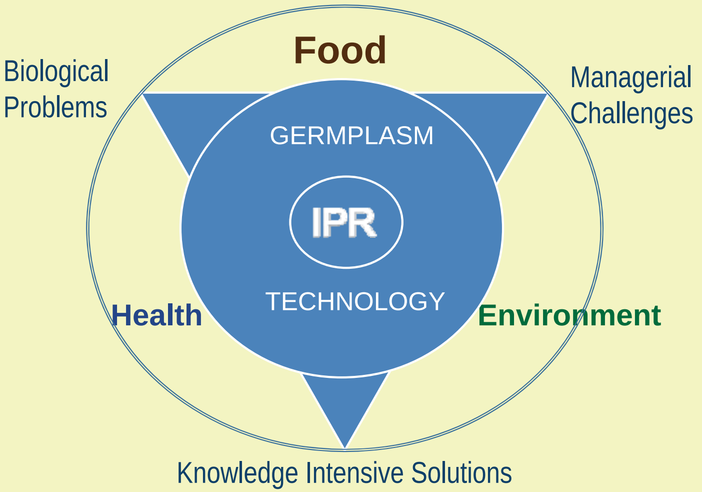
I am very much thankful to WIPO, Rolf, my organization, i.e., ICAR and also to all of you for listening.

Seminar on How the Private and the Public Sectors Use Intellectual Property to Enhance Agricultural Productivity
Geneva, June 14, 2011

Analysis of Opportunities and Challenges in Intellectual Property Rights and Agriculture in the Indian Context

Sudhir Kochhar
National Coordinator (C-4)
Basic and Strategic Research
Project Implementation Unit (PIU)
National Agricultural Innovation Project (NAIP)
Indian Council of Agricultural Research (ICAR), New Delhi





- Inefficient and ineffective information and knowledge flows may severely constrain development in food and agriculture

Enterprising in food and agriculture

Primary products	Industrial Derivatives	Agricultural inputs
Grains / Staples	Edible Oils, Cake & Meal	Seeds & other Planting Material
Fruits & Vegetables	Sugar, Tea, Coffee, Tobacco	Farm Power & Machinery
Condiments & Spices	Fibre: Cotton, Jute, Coir	Tools & Implements
Milk & Eggs	Food products/ Value added Food products: Breakfast/ processed/ canned foods Baby foods	Agro-chemicals Fertilizers, growth promoters, pesticides/ weedicides
Meat * & Fish	Aromatic oils/ Flavours	Bio agents
Fodder	Feed Mix	Hi-Tech nursery
Cold storage	Nutraceuticals	Sprinkler/ Drip irrigation equipment
Processing & Value addition	Plant based medicines	

Goals for Genetic Transformation vis-à-vis IPR

Traits/Goals	Broader Public Good	Enterprise
Production	+++	+
Productivity	+++	+
Nutritional value	+++	+
Metabolic Pathway regulation	++ Basic researches	+
Phytoremediation	+	++ Applied value
Pharmaceutical compounds	+	+++
Industrial value	+	+++

Patent Search At A Glance

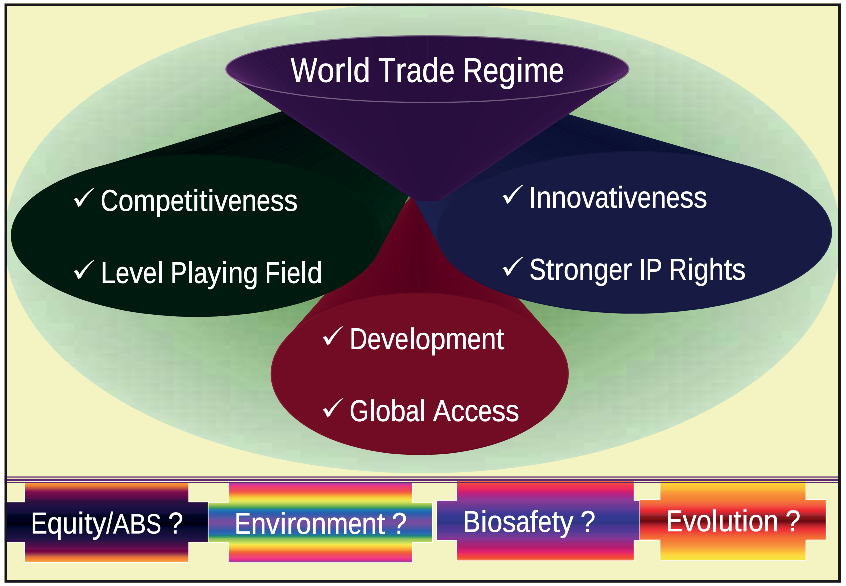
Search Date

USPTO 22.2.2007

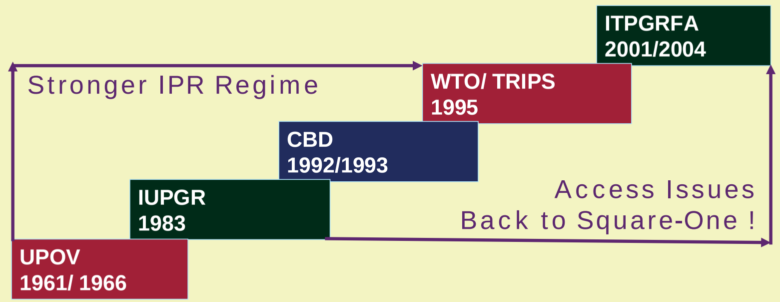
World Database@espacenet 23.2.2007

Search for	USPTO In Claims	USPTO In Title and Abstract	Others[2] In Title and Abstract	World[1] In Title and Abstract
inbred line	807	791	659	1450
cultivar	6335	6805	516	7321
variety	13516	35277	60596	95873
hybrid	13541	13296	44753	58049
microbe	501	304	3604	3908
microorganism	6255	3629	25302	28931
clone	1086	657	3101	3758
primer	7965	3835	22720	26555
marker	13667	6960	31783	38743
gene	14133	13341	76511	89852
probe	31824	21822	78178	100000

[1] world database @ espacenet [2] Other than US Patents



IPR in Agriculture: Institutions & Capacity Perspective



- **Extravagance in institutionalizing and governance**
- **Wastage of resources and time in**
  - generic trainings lacking focus on need-based HRD
  - technology incubators without apt R&D or grass-root links
- **Paucity of resources and will-to-invest in**
  - basic research and innovation

Lawful protection of IPR and Equity (ABS)

1. Framework	**Common Law jurisprudence** • protection based on use or reputation, even without registration • Passing off remedy applicable **Civil Law jurisprudence** • protection dependent on registration • protection available on proof of registration in the country of dispute as well as country of origin
2. Definition (Interpretation)	'***Nemo dat quod non habet***': 'He who does not have a title in a property cannot transfer the same.' ***'Qui prior est tempore potior est jure':*** 'As between persons having only equitable interests, if their equities are in all other respects equal, priority of time gives the better equity.'
3. Mindset	Individual (Private) rights [Economics] ***versus*** Community (Collective) rights [Socio-economics]

Farmers' Rights

1979: Chair, Commission II of FAO General Conference (MSS): compared irony of the poverty of primary conservers co-existing with the prosperity of commercial breeders

1981: resolution moved at FAO General Conference, emphasizing need for equity in sharing benefits from a nation's agro-biodiversity heritage

1983: setting up of CPGR (MSS: Independent Chairman);

1989: FAO Council's Resolutions 4/89 and 5/89: birth of the concept of farmers' rights

1992: Nairobi Final Act (Art.4): Need to resolve outstanding issue of FR

2001/2004: ITPGRFA (Art. 9) : [realization of] Farmers' Rights

The loss of every gene and species limits our options for the future. This is why genome and gene saviors are invaluable; their efforts provide the tools to meet food security challenges – M S Swaminathan

Source: The Hindu On Line e-paper Saturday, Feb 17, 2007

Inventions not patentable in India

under the Patents Act, 1970

sec.3(h): methods of agriculture and horticulture

sec.3(b): inventions contrary to public order/ morality or prejudicial to human/ animal/ plant life/ health/ environment

sec.3(j)*: plants in whole or in part (other than microorganisms) including seeds, varieties, species and their production and propagation by essentially biological process

sec.3(n): a presentation of information

sec.3(p): invention, which is in effect traditional knowledge or an aggregation of or duplication of known properties of traditionally known component(s)

Exceptions U/s 3(b) & 3(j) are permissible under TRIPS Art. 27.2 & 27.3(b), respectively

* Whereas there are no patents for transgenic plants, these may be protected as essentially derived varieties (EDV) under the PPV&FR Act, 2001

Disclosure requirements

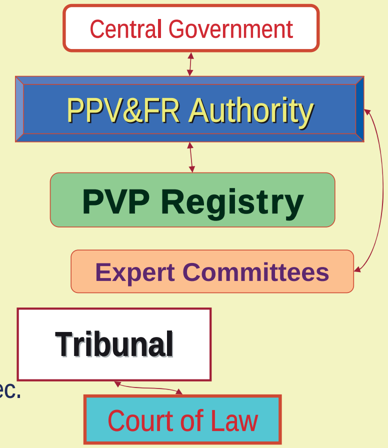
Sufficiency of disclosure: U/s 10(4)(ii)): required to deposit a sample of the material in a notified repository – an IDA under Budapest Treaty; e.g. Microbial Type Culture Collection and Gene Bank (MTCC) at IMTECH, Chandigarh

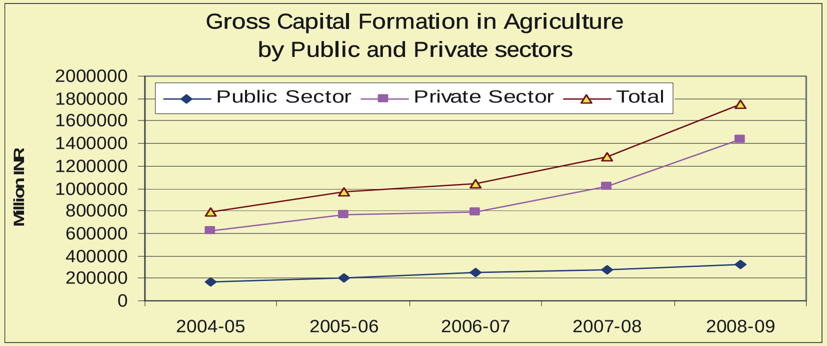
Disclosure for source and geographical origin of biological materials: U/s 10(4)(ii)(D): required to give particulars of deposit made in the patent application

Non disclosure or wrongful disclosure of GR & TK is a ground for opposition (both pre-grant U/s.25(1) and post-grant U/s.25(2)) and revocation (U/s 64(1)(p)&(q)): There can be opposition of application/patent or revocation of patent due to non-disclosure or wrongful disclosure of source or geographical origin of a biological material used in the invention and anticipation of the invention through prior knowledge oral or otherwise within any local or indigenous community

Unique *sui generis* provisions of the Protection of Plant Varieties and Farmers' Rights (PPV&FR) Act, 2001

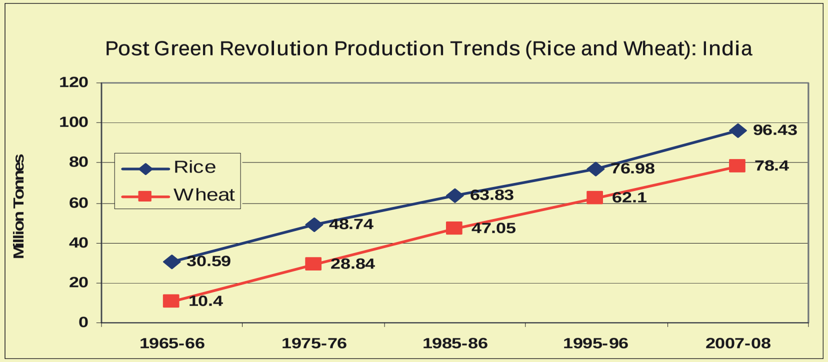
- Protection of Extant Varieties {Sec. 8 (2) (a); 14 (b); 28 (1) Proviso; 29 (2)}
- Farmers' Rights (Chapter VI)
- No to GURT {Sec. 29 (3); 18 (1) (c)}
- Benefit Sharing (Sec. 26)
- Compensation for Under-Performance [Sec. 39(2)]
- Claim for Community Right (Sec. 41)





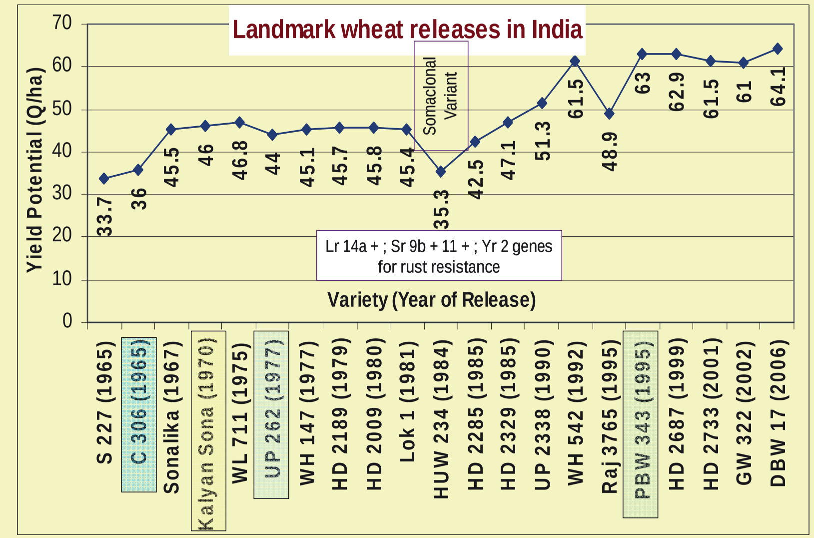
Source: Central Statistical Organisation, New Delhi.

- Share (%) of Agriculture & Allied Sector in Total Gross Capital Formation in India has increased from 7.8% in 2004-05 to 9.2% in 2008-09
- Contribution of Private Sector has correspondingly increased from 8.1% to 10.3% whereas Public Sector contributes around 6-7%



Source: Ministry of Agriculture. Agricultural Statistics at a Glance

- Production Jump of ~ 20 Million Tonnes (21.3%) in Total Foodgrains
  in Green Revolution Period: 89.36 mt (1964-65) to 108.42 mt (1970-71)
- The technology-led gains were sustained/ enhanced
  Overall Foodgrains: 50.82 mt (1950-51) to 234.47 mt (2008-09)
  Strength: domestic Public R&D and International Cooperation



Source: Directorate of Wheat Research (ICAR)

Food Sector in India: SWOT analysis

India: the second largest producer of food in the world

• Food industry	US$ 180 billion
• Food processing industry	US$ 70 billion
• Supply chain	Sub-optimal
• Investment	Low
• Share of FDI flows in India (2000-2010)	3.3%

Opportunities

- Growth expected in food retail industry US$ 150bn by 2025
  - Fast changing demographics and habits
  - Change in consumption patterns
  - Evolution of innovative food processing capacity
  - Emergence of organized retail
- Country-wide popularization of brands that may re-engineer back-end processes and optimize supply chain management system

Operational Holdings (2000-01) and Debt Incidences in India

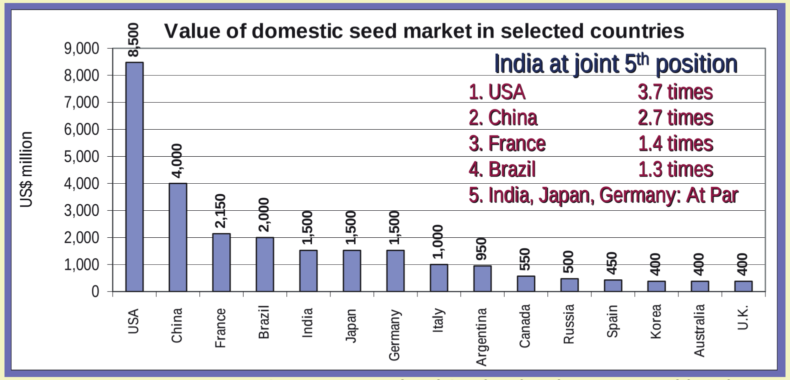
No. of Holdings: ('000 Number)
Area Operated: ('000 Hectares)
Average size: (Hectares)

Category of Holdings	Operational Holdings			Area Operated		indebtedness
	Number	%	Av. Size (ha)	Area	%	%
Marginal (< 1 ha)	75408	62.3	0.40	29814	18.7	33.0 (M.P.) – 88.7 (W.B.)
Small (1.0 to 2.0 ha)	22695	19.0	1.42	32139	20.2	8.5 (W.B.) – 27.1 (M.P.)
Semi-Medium (2.0 to 4.0 ha)	14021	11.8	2.72	38193	24.0	2.4 (W.B.) – 23.3 (M.S.)
Medium (4.0 to 10.0 ha)	6577	5.5	5.81	38217	24.0	0.4 (W.B.) – 14.1 (Raj)
Large (≥ 10.0 ha)	1230	1.0	17.12	21072	13.2	0 (W.B./Or) – 4.5 (Raj)
All Holdings	119931		1.33	159436		

Source: Ministry of Agriculture. Agricultural Statistics at a Glance
Source : National Sample Survey 59th Round (January-December 2003)

Seed Sector in India

Commercial world seed market	US$ 42 bn approx
India's share in World Seed Trade	< 1 %
Value of Indian domestic seed market	US$ 1,500 m



Source: International Seed Federation <www.worldseed.org>

Seed Sector in India – contd.

Domestic seed market : In value terms

Commercial seed market (coverage of the potential)	25%
Public sector	24%
Private sector	43%
Unorganized seed sector	33%
Hybrids (coverage of organised seed trade)	40%

Domestic seed market : In volume terms

Rice and Wheat	85%
Cereals and Millets	96%
Other crops	4%

Seed import and export

Year	Field crops	Vegetables	Total
		Seed import	
2008	US$ 13 million	US$ 19 million	US$ 32 million
2009	US$ 15 million	US$ 37 million	US$ 52 million
		Seed export	
2008	US$ 16 million	US$ 9 million (1540 Metric Tonnes)	US$ 25 million
2009	US$ 16 million	US$ 17 million (3870 Metric Tonnes)	US$ 33 million

Indian Context: Some Key Milestones

1950s	Indian Maize Hybrid (release in 1961)	**AICRP (1957)**	Small Seed Companies (in Veg & Ornamentals)
1960s	Semi-dwarf Varieties of Wheat and Rice	**UPOV (1961/72)**	National Seed Agencies/ Farmers'/ NARS' Role
1970s	First Hybrid Cotton	NSP (1976)	State Seed Corporations
1980s	New Policy on Seed Development (NPSD)	**IUPGR** (1983)	Breeder Seed to both sectors Private sector surge (in Hybrids)
1990s	National Gene Bank: capacity 1 million samples	CBD, TRIPS	R&D in seed sector: Private Sector interest in AICRPs
2000s	New IPR regime, Cotton Transgenics	ITPGRFA (2001/2004)	More attention on SRR New generation varietal products or better market strategy?*

* wheat variety PBW 343, rice hybrid PRH 10, cotton transgenics >90 hybrids

Private Seed Sector acknowledges Public Sector Contributions

- Many small and medium sized companies produce/ market popular varieties released by public Institutes (ICAR/ SAUs)
  - Selective list provided
- Private seed companies have also been benefited as these releases formed the base material for the start of their breeding programs
  - Okra hybrids developed and sold by private companies today owe their success to releases resistant to YVMV
  - In tomato, private industry has successfully used the bacterial wilt resistant lines released from public institutes to develop resistant hybrids

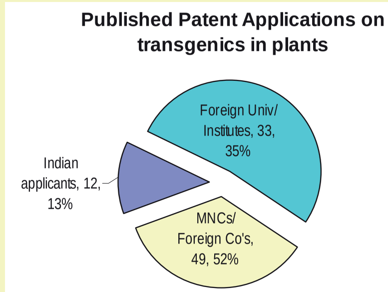
Source: Deepak Fertilisers and Petrochemicals Corp. Ltd. <www.deepakgroup.com>

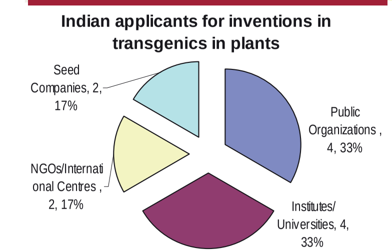
Industry for other agricultural inputs

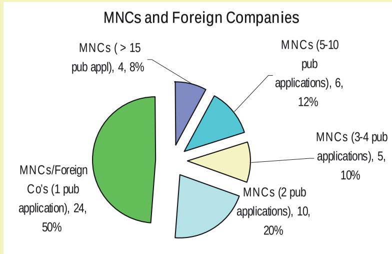
Fertilizers	**US$ 30 billion**
Agri-equipments	**US$ 5,500 million**
Pesticides	**US$ 1,500 million**
Other input products with huge market potential	**Biofertilizers Biopesticides Bioagents (pollinators) Micronutrients, Soluble fertilizers**

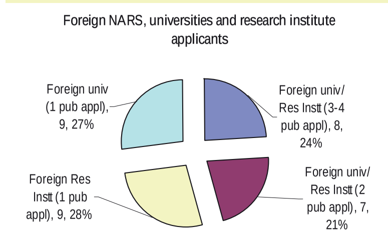
- **Predominately non-exclusive marketing presently**
- **Market goodwill ensured by**
  - well known brands (registered or unregistered trade marks)
  - organized chain of registered retailers
- **Patenting in agriculture taking momentum**
- **Future marketing of knowledge intensive input product packages** under the exclusive patent regime may depend on how patenting in biotechnological products sets its pace

The recent IP influx









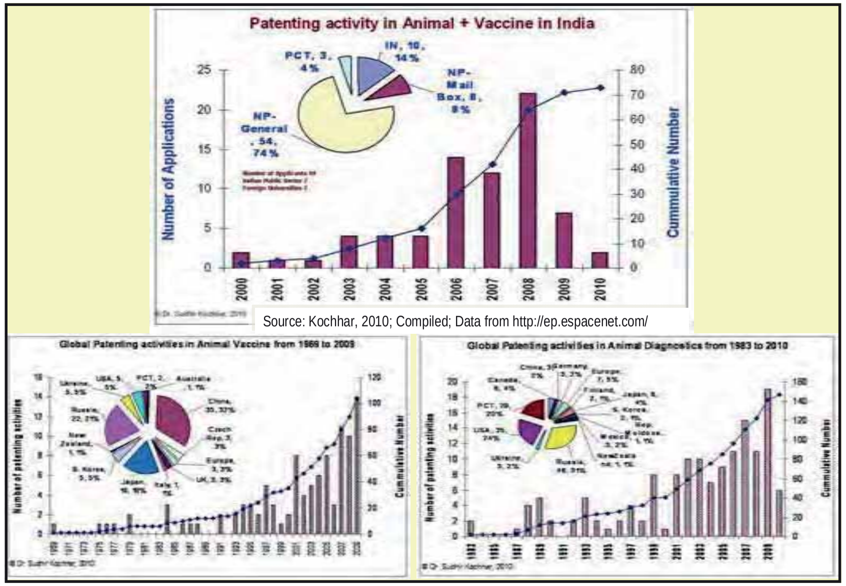
Novel proprietary technologies in plant transgenics entering the Indian agriculture landscape

Field	No. of Appl. (Applicants)	Genes/ Crops/ Other features
Food Crops	33 (17)	Rice, maize, sorghum, chickpea, pea, soybean, okra, tomato, sunflower
Transgenic Event	7 (4)	PE-7 (Rice), PE-4 (Rice), MON 89034 (Maize), DP-098140-6 (Maize), MIR I62 (Maize), Elite/ undescript (Okra), Detection
Yield Increase	13 (4)	HSRP, SHSRP, ACCDP, MTP, ste20-like expression, RNA-editing to generate male sterile lines
Drought Tolerance	5 (4)	via a plastid genome, nucleotide sequences, encoded polypeptides, non-descript,
Disease/ stress resistance	20 (13)	Soybean rust, Squash Mosaic Virus, PITA gene, Commelina Yellow Mottel Virus, Cassava Vein Mosaic Virus, Cestrum Yellow Leaf Curling Virus, Bacterial blight of rice, multiple resistance, others

Patentees by Category of the Granted Indian Patents for "Transgenic Plant" (as on 1.3.2011)

Foreign Companies	Cropdesign N. V., Monsanto Technologies LLC, Syngenta Participations Ag, Pioneer Hi-Bred International Inc. BASF Plant Science, Bayer Bioscience, Centocor, Inc., Japan Tobacco, Inc, Meristem Therapeutics, Senesco Technologies Inc., Agrivida, Inc, Avestha Gengraine Technologies Pvt. Ltd., Chromagenics B.V., Dow Agrosciences LLC, E.I.Du Pont De Nemours & Co. Fraunhofer-Gesellschaft Zur Forderung Der Angewandten Forschung E.V., Kweek-En Researchbedrijf Agrico B.V , LTA Resource Management Maxygen, Inc., Nippon Paper Industries Co Ltd., Protalix Ltd., Warner-Lambert Company LLC
Foreign Universities/ Institutes	Auburn University, Bar Ilan University, Texas Tech University, The University of Chicago, University of Central Florida, The Hebrew University of Jerusalem, Leibniz-Institut fur Pflanzengenetik und kulturpflanzenforschung (IPK), Max-Planck Gesellschaft
Indian Universities/ Institutes	ICAR (Indian Agricultural Research Institute), Bose Institute, Tamil Nadu Agricultural University
Foreign Individuals	Raab, R. Michael, Yeh, Shyi-Dong

Source: Kochhar, 2011. JIPR 16(2) 69-3; Compiled; Data from http://ipindia.nic.in/... patent search.



Source: Kochhar, 2010; Compiled; Data from http://ep.espacenet.com/

Protection of Plant Varieties

Number of PVP applications 2220

Up to 31.12.2010
2119 Extant
1222 New
841
EDV 1
Farmer 55

From 1.1.11 to 1.3.11 101 mainly new

http://www.plantauthority.gov.in/application.htm

Grantee	Titles issued
Public Sector	
Indian Council of Agricultural Research	186
Orissa University of Agricultural &Technology	7
Birsa Agricultural University	2
Dr. Panjabrao Deshmukh Krishi Vidyapeeth	3
Private Seed Companies	
New Nandi Seeds Corp.	7
JK Agrigenetics	4
Maharashtra Hybrid Seeds Co. Ltd.	2
Ajeet Seeds Ltd.	2
Vikram Seeds Ltd.	1
Farmers	
Individual Farmers	3
Total	217

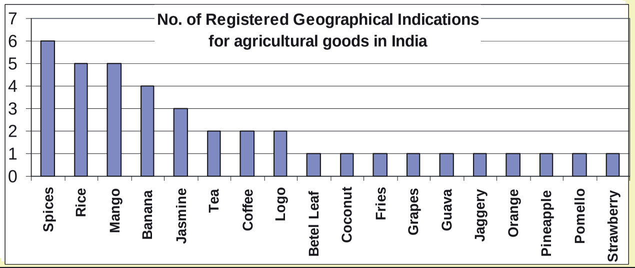
GI Protection

Local Preferences/ Practices/Products ⟷ GI ⟷ Global Market

Geographical Indications: a "way out"

- **from subsistence to commercial agriculture**
- **a model of "industrial agriculture"**

there is scope for the registered GI owners to explore partnerships for international trade of some of these GIs



Changing Nature of Research / Innovation Providers

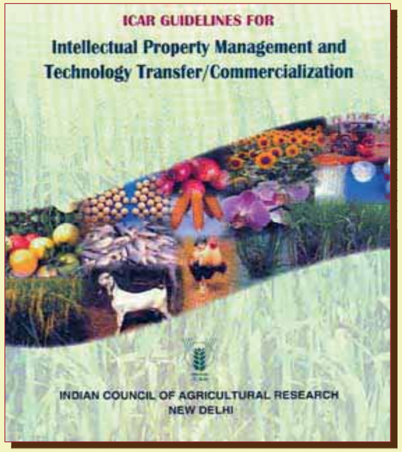
- **Public R&D System**
  - NARS-SAUs, Incubators, Business Planning and Developers
  - International Research Centres / Foreign NARS & Universities
- **Private R&D**
  - Multinationals / Foreign Companies
  - National Companies
- **Non-Governmental or non-profit organizations**
- **Farmers**: Farmers Breeders, Farmer Innovators (Participatory and Individuals), Farmer Conservers
- **Trade Promoters / Traders**
  - Export Promotion: Commodity Boards for key export commodities (tea, coffee, coconut, spices, etc.)
  - Traders & Knowledge providers in agriculture in domestic circuits

Delivery Mechanisms: Private Extension Services

- Community Based Organizations
  - **Farmers' Organizations, Farmers' Cooperatives, Self Help Groups, Farmer Interest Groups, etc.**
- Para Extension Workers
  - **Contact farmers, link farmers, master farmers, gopals, mitra kisans, mahila mitra kisans, etc.**
- Agri-Clinics & Agribusinesses
- Input Suppliers/ Dealers
  - **Pesticides, Seeds, Nutrients, Farm Implements, etc.**
- Corporate Sector
  - **Commercial Crops Seeds – tobacco, tea, coffee, oilseeds (sunflower), vegetables, etc.**
  - **Farm Implements – tractors, threshers, sprinklers, drip irrigation, etc.**

Positive interventions in Agri-Biotech by ICAR-DARE

- Public funding for research and higher education in Agri-Biotech
- Research networks in Agri-Biotech
- Crop/ Commodity based vast infrastructures
- Collaborative research – Public-Public and Public-Private Collaborations
- Well-defined / described IPR / Commercialization Policy and Guidelines
- Policy support and Technical Backstopping



Policy & Guidelines

Implemented vide o/o
F.No. 14-01/2006-IPR-Policy Plng.
w.e.f. 2nd October, 2006

Execution

- **3-tier management mechanism**
  - **Institute level**; Zonal; Central
- All ICAR Directors are delegated with the powers to file patent/ IPR applications at the respective offices/ registries in whose jurisdiction concerned institution is located - vide o/o F.No. 6(2)/2001-Cdn(A&A) Dated 1.12.2005/ … /…

Soft copy available at ICAR webpage:-
http://www.icar.org.in/files/reports/other-reports/icar-ipmttcguide.pdf

Salient IPR protected ICAR technologies commercialized

- Rapid Detection of ***Bt*** Cry toxin
- Bt-1, ***B. bassiama*** formulation, ***T. virde*** formulation
- Biopesticide formulation, neem based pesticides
- Production of antagonistic fungi
- Plant varieties/ Hybrids/ Transgenic events,
- FMD vaccine, Vaccine for ***peste de petits*** ruminants, Crystoscope,
- CIFAX, CIFACURE, CIFACRYO, Jayanti Rohu, FRB portable Carp Hatchery
- Low energy de-hulling of mustard seed, cheaper bleaching material, maturity index calculator, groundnut pod decorticator, aonla beverage
- CRIJAF Seed sowing machine
- Copra drier, copra chips making machine
- Cassava starch graft poly (acrylamide), extruded cassava snacks
- Immobilizing matrix from bagasses for bacterial biomass
- Software

Strengthening basic and strategic research in frontier areas of agricultural sciences

NAIP Component-4: 61 consortia; 253 partners; 10 Public-Private Partnerships; Aug 2007-Sep 2009

Research focus is on molecular and nano aspects; on following themes:

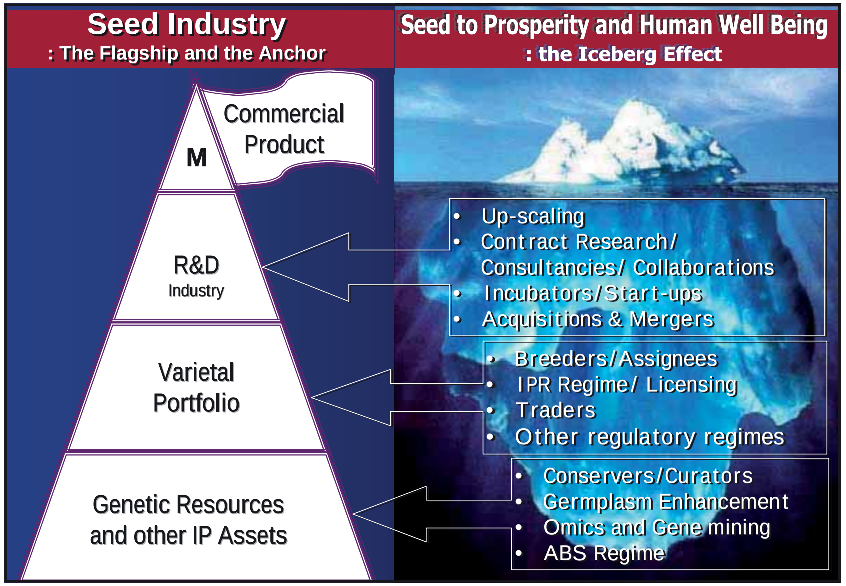
- Stress (abiotic/biotic) tolerance in agriculture
- Molecular genetics and breeding
- Nanotechnology
- Precision farming
- GIS application in agriculture
- Natural resource management
- Structures and processing engineering
- Social sciences in agriculture
- Animal Reproduction & health
- Sensor network for cattle yard management
- Milk and dairy production
- Rumen physiology and ecology
- Meat production

- Many important genes and other resources deposited to GenBank

First commercial plant virus detection kit (ELISA based)

Garima-II: The first buffalo calf produced from Stem Cell research

Colour based method for detection of detergent in milk



Incentivised building up of new diversity for future use

1. Build up/ avail opportunity/ potential to support cryptic evolution under intensive agriculture systems
2. Innovative discovery and selection of desirable variants in climate change context
3. Public disclosure of innovations (variants) and their derivatives in patent/ PVP applications
4. Public access of new inventions/ innovations through licences/ cross-licenses to allow furthering the cryptic evolution.
5. Develop Suitable/ Ethical Codes to (and) pool/ share molecular resources (genes/ promoters/ QTLs/ markers/accessions)

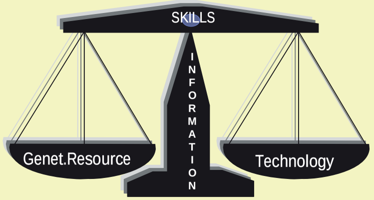
Incentivised building up of new diversity for future use: Managing IP outputs and ABS

- **Materialize joint IP ownerships.**
  - Facilitate attempting some suitable license agreements/ benefit sharing arrangements among the stakeholders
- **Assign IP to governments** or at least provide a world-wide royalty-free license for any commercial or strategic use in the public domain
- **Encourage compulsory licensing** to provide access to assigned genes/ genomes for all interested R&D establishments
  - Licence fee/royalty may go to national funds for **IP/Biodiversity**
- **Incentivise on-farm conserver innovators** through reasonable compensation from national funds
- **Firm up workable** out-of-the-box **institutional interventions** at legislative, policy and administrative levels

Facilitated collaborative public-private R&D

- The private sector should appreciate that in general the public research system is either shy or conservative/ orthodox in the negotiation process and in drafting/ execution of appropriate MoUs/ Collaborative R&D Agreements.
- A properly developed 'Clearing House Mechanism' for gathering/ distributing/ disseminating information on germplasm available with various collaborators/ stakeholders would be helpful
- Proprietary and non-proprietary pools of resources and tools in various fields, for use in R&D by collaborating partners on prior-informed/mutually-agreed terms should be developed / managed as a part of the collaborative project activities

Need for an academic build up of the IPR subject



- To overshadow superfluous, redundant and often-confusing literature/e-literature
- To produce duly streamlined, simple and effective theories, practices and bridging theories; and uniform curricula for schools and colleges- - UG & PG levels
- To update and publish standard textbooks on IPR

It's important to sustainably harness both value and worth

ACKNOWLEDGEMENTS

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Dr. Bangali Baboo, National Director (NAIP)
My Family & Children

Thanks

<skochhar2000@hotmail.com>

Patents on Plants: A tool or threat for sustainable agriculture?

The role of intellectual property rights on plant innovations

Michael A. Kock*, Christine Gould **

1. Demand for agricultural innovation

Agriculture has seen two major innovation waves so far, but more is needed in order to sustainably feed growing populations with changing diets. The first "green revolution" in the middle of the last century increased crop yields, particularly in corn, wheat and rice.[1] Over the last two decades, biotechnology provided a second “green revolution” and further helped to boost yields globally. Since 1997, the increase in US corn yields, for example, moved above the previous linear trend and corresponds with the commercial biotechnology maize area.[2] Such increases in productivity are necessary to nourish a rapidly-growing world population without the need to clear new land for farming. The world's population will grow from 6 billion today to almost 9 billion by 2050, and farmland acreage per capita will reduce.[3] In addition, higher calorie demand and an increased use of crops for biofuels will require agricultural production to increase by 70% by 2050.[4] Climate change and decreasing availability of water will add further complexity to the situation. It is clear that the world’s farmers face unprecedented challenges that can only be met with integrated solutions that combine high quality seeds, modern crop protection and resource-saving agricultural technologies. The need for a continuous flow of innovation is undeniable.

The seed industry is undergoing a rapid technification to develop new plant varieties that are adapted to ever-changing environmental conditions and help farmers grow more while using fewer natural resources. Only few decades ago breeding was largely an empirical science based on trial-and-error, however, today’s plant innovations are developed using sophisticated science and technology, including cell biology, genome and proteome research, gene mapping, marker-assisted breeding and hybridization.

1. Intellectual property rights for plant related innovations

1.1 The necessity for intellectual property rights

Developing new crop varieties is lengthy and costly, with plant science companies investing approximately 15% of their annual seeds turnover into seeds-related research and development activities.[5] Bringing a new biotechnology trait to the market currently costs around US $200 million[6] and takes approximately 10-15 years[7]. These figures are increasing rapidly due to mounting regulatory requirements.

High investments into technology and complex traits can only be justified if an adequate return on the investment is ensured. This is particularly challenging in the seed industry where the fruit of innovative research into new plant varieties is a simple, yet high-tech product: seed. Once sold,

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* Dr. rer. nat., European Patent Attorney, Head IP, ** Global Public Policy Manager, c/o. Syngenta International AG, Switzerland. The view expressed in this article are the personal views of the authors. This paper corresponds to a presentation of the author at the Conference on Intellectual Property and Public Policy Issues (WIPO; Geneva, June 14, 2011).

1 US corn yield increased from 1.8 t/ha in 1940 to 8.5 t/ha in 2000. International Seed Federation 4-5 (2002).

2 McLaren JS (2005) Trends in Biotechnology 23(7), 339-342

3 Saatgut für die Menschheit, International Seed Federation (2000). Arable land decreased from 1950 to 1996 from 0.23 to 0.12 hectares per person and will decrease until 2030 to 0.08 hectares per person. The growth rate for arable land is approx. 0.2% per year, while growth of world population amounts to 1.3%. Kompendium Gentechnologie und Lebensmittel, Band 1, 18 (2003).

4 OECD-FAO Agricultural Outlook 2010-2019 – Highlights; http://www.agri-outlook.org/dataoecd/13/13/45438527.pdf

5 Figures vary from company to company. In 2009, the percentage of seeds turnover reinvested into seeds-related research and development for the leading companies were: 11% (Pioneer Hi-Bred), 15% (Monsanto), 14% (Syngenta), 27% (Bayer CropSciences), 31% (Dow) (company press releases).

6 http://www.economist.com/displaystory.cfm?story_id=14904184

7 Of these, 5–10 years for R&D, at least 3 years for GM regulatory approval, plus 2–3 years for seed marketing acceptance and testing for plant variety protection.

seeds are in most cases easily reproducible and do not require repeated purchasing.[8] In this respect, the seed industry faces similar challenges to the entertainment or software industries in that its products can be easily copied by both competitors and customers.[9] Robust intellectual property (IP) protection is therefore critical.

Moreover, the advancement of science and the use of sophisticated, marker-assisted breeding technologies allows for the fast and easy circumvention of plant variety protection (PVP) and trade secrets as the traditional IP protection regimes for plant-related inventions.[10] Therefore, patents are increasingly used and important as for the protection of modern plant-related inventions.

The resource requirements, high costs, and complexity of technification in the plant breeding sector have induced a change in the industry structure[11]. Consolidation by mergers and acquisitions has formed larger companies with the critical mass and capacity to succeed in such an environment. This trend is not always welcomed, but is potentially unavoidable and inherent in view of the technological developments. It is important to note that the increasing use of patents in the plant breeding sector is a consequence of (and not a cause for) the increasing investments in R&D. This is a trend not unique to the seed industry, but a part of any research-intensive industry.

1.2 The function of IP as a tool

In today's knowledge-based society, the ability to innovate drives an industry's economic performance and competitiveness. This ability is influenced by two critical factors: the strength of IP protection conferred as an incentive to the innovator and the freedom-to-invent under IP rights. Both factors need to be balanced to ensure an optimal flow of innovation.

Patents and other forms of IP protection provide an incentive for innovation and encourage creative dynamism and technology transfer in the plant science industry. The R&D process is resource-intensive, lengthy and risky, and requires continuous technological innovation, yet the outcome of this process is a seed product that can easily be copied by competitors and growers. In this regard, seed is comparable with software, another high-technology product which can be easily "propagated" (copied) if not protected by IP.

1.3 The current IP tool kit for plant-related innovations

The need to protect the IP rights of plant breeders was recognized by legislators as early as the 19th century.[12] Until 25 years ago, plant related innovations were represented essentially by plant varieties with an improved overall germplasm performance. Those innovations were almost exclusively protected by plant variety protection (PVP).

PVP is suitable for new plant varieties developed by empirical (traditional) breeding efforts and protects the new variety on the basis of its phenotypical - often observable - characteristics. The requirements to be granted PVP rights are relatively low. To qualify as a new variety, a cultivar has to be Distinct (that is, recognizably different from other varieties), Uniform (each plant must show the same characteristics) and Stable (seed must breed true from year to year) (DUS).[13] No inventiveness or improved performance is required. The PVP right covers variety constituents (e.g.

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[8] The unauthorized "copying" of seeds by customers (farmers) is a significant problem for open-pollinated crops like soy or wheat. Illegal and legal "farm-saved-seed" on average reduces revenues by more than 50%.

[9] Beside the similarities in infringement, both the seed and the entertainment industry are faced by a strong open source movement which challenges the IP protection for seed and entertainment respectively.

[10] While 20 years ago a normal breeding cycle would be expected to take between 5 and 12 years depending on the plant species, nowadays - with new breeding and nursing techniques - this period is reduced by 50% or more

[11] In commission of the Commission on Genetic Modification (COGEM; Netherlands), Schenkelaars Biotechnology Consultancy (NL), LIS Consult (NL) and Prof. N. Kalaitzandonakes (University of Missouri; US); Study "Drivers of Consolidation in the Seed Industry and its Consequences for Innovation".

[12] The Paris Convention for the Protection of Industrial Property of 1883 classifies agricultural products as industrial products and as in principle accessible to patent protection (Art.1.3).

[13] Reg. (EC) No. 2100/94 on Community Plant Variety Rights (CPVR). In contrast to patents novelty is linked to the commercial use of the variety (Art. 10 CPVR).

seeds) of the protected variety as a concrete material subject.[14] The right protects the specific variety as characterized by its essential (phenotypical) characteristics. In general, only varieties resembling all those characteristics are protected.[15] In this sense, PVP can be seen as a type of "copyright" for plant varieties in that it prevents the unauthorized copying (propagation) of a protected variety for commercial purposes.

PVP laws contain a statutory breeders' exemption that allows for the use of a protected variety for further breeding. This recognizes that new plant varieties are always "created" from existing plants. On the other hand, the "breeders' exemption" permits competitors to cross individual traits or genes from a PVP-protected variety into a wide range of varieties. In consequence, the PVP system is necessary and well adapted to protect certain achievements in plant breeding, but it is not suitable – nor is it intended - to protect all plant-related innovations. For genes, traits and improved methods of breeding, the patent system is an essential protection tool.

The prerequisites for grant of a patent are novelty, inventive step or non-obviousness, and industrial applicability.[16] In addition, the invention must be described sufficiently clearly and completely for it to be carried out by a person skilled in the art.[17] As for any new technology area, it has taken time and iterations to build the experiences at the patent offices and courts to apply these general principles to a new matter. Now with 25 years experience, these criteria are sufficiently clear for biotechnological inventions, however there is still room for improvement for inventions relating to breeding innovations (see below).

Through the disclosure requirement, patents provide incentives to share the related information in a way which enables other breeders to work with and further improve upon prior inventions. Thereby, patents are an important tool to help to foster innovation, knowledge sharing and technology dissemination. Through patents, many important disclosures have been made, which have bolstered innovation cycles.

The issue of "patents on plants" is sensitive and often produces an emotional rather than objective response. Part of the reaction comes from a misunderstanding about the role of patents. To be clear: the concept of "life" cannot be patented, and patents neither confer ownership of a living organism nor any active right to use a patented material or technology. Rather, a patent provides the right to exclude others from making, using, selling or importing the patented invention for a period of time. In a sense, patents can be thought of as a type of legal "fence" surrounding a property. Like a fence around a piece of land, patents obtain value only from the property - the invention - they protect, and can be used to block or to allow access to the invention (i.e. through a license, a type of "gate").

The WTO TRIPS Agreement requires countries to provide protection for plant-related inventions *"either by patents or by an effective sui generis system or by any combination thereof.*[18]*"* All states have taken advantage of the flexibility provided in TRIPS and found own "combination" of patent and *sui generis* (PVP) systems, which has resulted in a patchwork of IP regimes with country-by-country differences unlike any other area of technology. Some countries - such as the US, Australia, and Japan - have no exemptions in their patent laws. Others like the European Patent Convention exempt claims that are limited to specific varieties, but allow generic patent claims on plants,

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[14] Art.13.2 CPVR. Strauss, GRURInt. 1993, 801. The scope of protection extends to other plant material (e.g., harvested goods) if the holder had no reasonable opportunity to exercise his right in relation to the variety constituents (Art.13.3 CPVR).

[15] According to the UPOV 1991 Convention the scope of protection for a variety extends to an "essentially derived variety" (EDV; Art.14.5b). EDVs „may be obtained for example by the selection of a natural or induced mutant, or of a somaclonal variant, the selection of a variant individual from plants of the initial variety, backcrossing, or transformation by genetic engineering."

[16] Art. 54, 56, 57 European Patent Convention (EPC).

[17] Art. 83 EPC; 35 U.S.C. 112.

[18] TRIPS Art. 27(3)b Members may also exclude from patentability […] (b) plants and animals, other than microorganisms, and essentially biological processes for the production of plants and animals, other than non-biological and microbiological processes. However, Members shall provide for the protection of plant varieties either by patents or by an effective sui generis system or by any combination thereof.

even if those can cover a multitude of varieties.[19] The majority of states do not allow patent claims on plants. Several of those provide PVP protection only for certain but not all plant species. This combination leaves a large number of varieties especially in the vegetable and flower area without any kind of protection, a situation which is not in compliance with the TRIPS requirements.

WTO members may also exempt "*essentially biological processes for the production of plants*" from patentability. Recently, the Enlarged Board of Appeal at the European Patent Office (EPO) interpreted this exemption in the precedential "Broccoli" (G2/07) and "Tomato" (G1/08) case.[20] They found that a "*non-microbiological process for the production of plants which contains or consists of the steps of sexually crossing the whole genomes of plants and of subsequently selecting plants is in principle excluded from patentability.*" It does not matter how technical or inventive a breeding process is, it is only patentable when it introduces a trait into the genome or modifies a trait in the genome of the plant produced. Processes which utilize naturally-occurring genetics are excluded from patentability, irrespective whether they include technical steps to enable or assist the crossing or selecting. It is important to note that the decision only covers breeding processes and does not affect the patentability of plants with native traits. The decision deviates from the principle that exceptions from patentability have to be construed narrowly. Such an approach was previously only taken with respect to diagnostic methods[21] - and in this case was based on the consideration that the legislative intent for the exemption is a general freedom-to-operate for physicians in the interest of the public.[22] Gaps in patent protection are deliberately accepted in order to free certain medical and veterinary activities from IP restrictions.[23] However, a similar legislative intent does not exist for essentially biological processes. The lack of patent protection for methods of marker-assisted (smart) breeding may cause innovators to keep their innovations and breeding knowledge as a trade-secret. This will affect the speed of innovation and potentially also investments.

In most countries, claims on man-made DNA sequences are available, which allow for an indirect patent protection of genetically modified plants. The extent of the protection is however limited: a decision by the European Court of Justice clarified that a DNA patent cannot be enforced on processed food products where the DNA is non-functional.[24] In this respect, the scope of patent protection is narrower than for PVP, where such an extension to processed products is provided.[25] It allows for an easy circumvention of patents in import countries by simple processing.

2. Evaluation of the IP protection for plants and its use

The above-mentioned court decisions fall within a trend of growing criticism around the world towards IP in general, and on patents on plants and other elements of human needs such as food, health, knowledge, and entertainment specifically. While the need for more plant innovations is clear, the role of IP, especially patents, in this context is debated.[26] Anti-patent sentiments are put forward by politicians, NGOs and even by some within the seed industry. In the recent report of the

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[19] Court of Justice of the European Union, Kingdom of the Netherlands v. European Parliament and Council of the European Union (Suspension of Directive 98/44/EC), Case-377/98, ABI. L 213, 13, Reasoning No. 46 (2001).

[20] Full text at EPO webpage http://www.epo.org/patents/appeals/eba-decisions/number.html?update=appeals. For review see Kock MA; Journal of Intellectual Property Law & Practice 2007 2(5):286-297; doi:10.1093/jiplp/jpm028

[21] Diagnostic inventions are except from patentability, if they comprise all of the steps specifically and narrowly defined by the Board. Additional steps do not change the character, but less or different steps would allow for patentability. G 1/04 "Diagnostic Methods", OJ EPO 2006, 334.

[22] This is demonstrated also by the fact, that those innovations were deemed not *"susceptible of industrial application*" Art.53 EPC.

[23] G 5/83 "Second medical indication / EISAI", OJ EPO 1985, 64; Reasons No. 22

[24] Court of Justice of the European Union; C-428/08 (Monsanto Technology LLC vs. Cefetra BV et al.).

[25] The UPOV Convention, a sui generis system according to Art. 27.3b TRIPS, confers under Art. 14.3 an extension to direct products obtained from the harvested material of a protected variety. In consequence, the importation of soybean meal obtained from a variety protected under the plant variety protection law would clearly construe infringement. To deliberately create such a gap in the patent laws seems to be - at a minimum - problematic.

[26] For an overview on the differing perspectives see Conference on Intellectual Property and Public Policy Issues (WIPO; Geneva, July 13-14, 2009), http://www.wipo.int/meetings/en/2009/ip_gc_ge/program.html

United Nations' Special Rapporteur on the Right to Food,[27] the industrialization of the seed industry and the increasing use of patents are criticized and named as the main obstacles in the fight against hunger, resulting in a dependency of poor farmers on multinational corporations and threatening agro-biodiversity. The report advocates "farmer's innovation" instead of commercial innovation. Faster diffusion of innovation is suggested by changing or completely removing the current IP systems.[28] Moreover, the IP position adopted by the Dutch plant breeders association Plantum essentially advocates for a free use of patented plants for further breeding and in consequence reduces the effects of patents to a mere copyright regime.[29]

While today the impact of patents on traditional breeders is very limited, it is a fair assumption that the progress of science and understanding in breeding (and particularly in the area of native traits) will enable more inventions and allow for an increasing number of patents in this area. This will have effects on traditional breeders: in the past, they could ensure a freedom-to-operate (FTO) under the PVP system rather easily by keeping a certain genetic distance from a competitor's variety. In a patent world, maintaining FTO will require significantly more efforts and often an analysis by lawyers. In order to commercialize seed that contains a patented native trait, a breeder must obtain a license from the patent holder. Some breeders claim it is often difficult to know when a patented trait is present and that obtaining a license is costly, time-consuming and creates uncertainty. In contrast to the PVP regime, a patent infringement can occur "accidentally" and even unintentionally without using a competitor variety.

While such FTO diligence is common in all other areas of technology, it certainly requires a change in the ways of working for traditional breeders. Building legal and IP capabilities, monitoring FTO and IP landscapes, filing for oppositions or negotiating licenses are only some on the potential consequences. In this context, some breeders are taking an extreme stance, calling for an abandonment of the patent system for native traits. The concerns of breeders are understandable, but denying patents on native traits (or making them available for free) will have the unintended consequence of stifling innovation by causing a reversion back to trade secrets as the sole remaining protection mechanism.

Abandoning patents to facilitate future breeding seems to follow the approach of "killing the hen to get to the egg." Current technology may become freely available, but innovation and investment incentives are reduced for the future. In the past, a breeder enjoyed a *de facto* exclusivity of at least 10 years (the normal breeding cycle) before a competitive breeder could establish a "me-too" variety - i.e. a variety containing the desired trait. Today, however, this advantage has been cut in half due to advancements in breeding technologies. This reduction in market advantage for the original breeder is insufficient to ensure an adequate return on investments. Many technologies, especially GM crops and complex native traits, require a high investment which cannot be recuperated in this time. [30]

While an abandonment of patent will shift the technology focus to "cheaper" products with shorter lifecycle, it may not prevent industry consolidation. The trend of technification can be slowed down but not stopped. Moreover, the assumption that a patent-free industry is more competitive is incorrect. In the software industry copyright is the predominant IP regime and patents have almost no impact. However, strong players have established dominating positions relying on trade secrets (source code). Similar scenarios can be foreseen in the seed industry if protection is limited solely to PVP.

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[27] De Schutter O, "*The right to food - Seed policies and the right to food: enhancing agrobiodiversity and encouraging innovation*"; http://daccess-dds-ny.un.org/doc/UNDOC/GEN/N09/424/73/PDF/N0942473.pdf?OpenElement.

[28] http://www.srfood.org/index.php/en/component/content/article/1-latest-news/261-current-intellectual-property-rights-regime-suboptimal-for-global-food-security

[29] http://www.plantum.nl/pdf/Standpunt_octrooi_kwekersrecht_extended_UK.pdf

[30] Further, the liability of technology providers would increase: While the producer and authorization holder for a GM plant is still under the obligations regarding monitoring and stewardship, he lacks means to stop third parties using his technology.

Thus, society is faced with a dilemma: without enforceable IP, companies would lack the incentive to take the risks necessary for successful innovation. With too much IP, technology dissemination is hampered. Better solutions can be found that balance the interests of breeders with the need to protect the patent system. Patents can actually be used to facilitate and improve technology dissemination in the area of native traits by:

- Improving the pre-requisites to get a patent - i.e. the quality of the tool.
- Improving and balancing the rights conferred by the patent and developing innovative technology dissemination mechanisms - i.e., the “use” of the tool.

2.1 Improving patentability criteria

As in any new area of technology, the early phase of patent application and review of breeding inventions was characterized by uncertainty of how to describe these new inventions and how to strike the right balance between the contribution of the inventor and the scope of the granted claims. During this time, patents have occasionally been granted with very broad claims. However, opposition and invalidation procedures resulted in the rejection or narrowing of these patents. Now, patent offices have gained more experience and the process is not substantially different from other technology areas. This demonstrates the self-calibrating capability of the existing patent system. While the patentability criteria for plant biotechnology innovations can be considered well established after more than of 25 years experience, patent offices are still struggling somewhat with patents on breeding innovations, including native traits. Not only is the prior art often in form of a public prior use and difficult to assess, also other criteria such as inventive step, adequate written description and enablement are difficult to grasp.

The standards for patenting of native traits should not be more stringent or less stringent than for any other technology. An invention needs to fulfill the requirements of novelty, inventive step (non-obviousness), and sufficient disclosure (appropriate written description and enablement). With respect to “native traits” the following need to be considered:

1. **Discovery vs. invention**: Innovations in breeding are sometimes alleged to be mere discoveries but not inventions. A discovery is a finding which lacks an industry use.[31] For example, the mere finding of penicillin would have been a discovery, describing its medicinal use as an antibiotic converts the discovery to an invention. For plant related inventions this means that a claim on a genetic has to have a phenotype and use, which is of relevance in the industry. This use needs to be specific, credible, and substantial. A generic use is insufficient.[32] However, for seed or planting material a specific use should almost always be given.
2. **Novelty:** Novelty in the patent system is an absolute novelty and not novelty in the commercial sense as in the PVP system. If a material exists in nature or on the market, finding a new property or trait in the material doesn’t make the material novel (inherent lack of novelty) and is not a valid base for a patent which would cover the plant. In other words, a patent cannot cover something which already exists in the public. In consequence, a plant comprising a native trait only satisfies the novelty criterion if:
    a. The trait is new as such, i.e. man-made by genetic transformation or mutagenesis.
    b. The trait is new in the specific plant species, i.e. it pre-existed in a different species but was transferred by breeding or transformation into the target species.
    c. The trait is based on combination of multiple alleles, which combination did not pre-exist in nature.

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31 Presumably the allegation that breeding innovations are discoveries is criticizing a lack of inventiveness.

32 Examples for lack of industrial use are the mere outcome of large scale sequencing, ESTs (expressed sequence tags) libraries, or markers without phenotype linkage.

3. **Inventive step (non-obviousness):** Even if a new finding is novel, it still needs to be inventive (non-obvious) to provide a patentable invention. There are sometimes statements that breeding innovations based on naturally occurring genetics are nothing more than "remixes" and therefore by default cannot be inventive. This view is based on a misunderstanding which links the patentability of a product to the patentability of the process of making the product. In a world where research is conducted in a highly automated, systematic way using procedures such as high-throughput screening, combinatorial chemistry, and molecular evolution, it has become established view by patent offices and courts that the patentability of a product needs to be judged on its structure and properties, which need to be non-obvious or meet a long-felt need. For breeding inventions this may – for example – suggest that a patent should not be granted for a known problem such as yield or disease resistance, if the solution is only an incremental improvement obtained by a routine breeding process. An inventive step has to be supported by surprising, unpredictable effects such as synergistic effects resulting from the combination of different alleles.
4. **Sufficient disclosure (written description and enablement):** Plant characteristics (traits or phenotypes) should be patentable only in combination with a structure i.e., a sufficient disclosure of the genetics causing the characteristic. For inventions based on naturally occurring genetics an enablement will in general require a deposit of the material or a clear description of public source from which the material can be obtained. A mere written description without access to the material is in general insufficient to "make" the invention. Further, enablement requirements will in general require that the scope of claims should be limited to the deposited material and progenies thereof.[33] Normally there will be no description how to find similar materials and broader claims will often be a mere invitation to start a research program. The suggested limitation will ensure that independent developments[34] by competitive breeders remain unaffected. The genetics in a claim is usually defined by reference to the deposit and markers which flank a region of several hundred thousand nucleotides. The scope of these claims is narrow and covers only the deposited material and progenies thereof. Independent developments should have larger variations. It is statistically unlikely, if not practically impossible, that an independent development results in an identical genetics to the deposit.

These requirements will enable the granting of claims with a consistent high quality and can be adapted within current legal frameworks, without changing patent laws. In Europe, for example, an adaptation of the examination guidelines could be realized within the context of the "raising the bar" initiative of the European Patent Office.

2.2 Improving the use of IP

While there is some room to improve and harmonize the requirements for patentability (see Section 2.1), the concerns about patents are triggered primarily by an often aggressive use by IP owners. This gives the perception that patents are essentially a tool to exclude others from accessing innovations. The function of patents as an incentive and to support technology dissemination (licensing) against a reasonable remuneration has become forgotten.

As with any tool, IP can be used in a constructive way (e.g., to foster innovation) or in a destructive or non-productive way (e.g., to exclude others and prevent sharing). The key challenge is to recalibrate the use of the patent system in a way that will maximize its beneficial effects. Any IP system must carefully balance the exclusive rights conferred to the innovator with the exceptions to these rights – i.e. the ability for third parties to further improve and conduct research without unreasonably limiting the initial innovators interests.

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[33] An exemplary claim could look like follows "A plant of the genus XY which expresses the phenotype of Z (e.g., Phytophtera resistance), which phenotype is conferred by the genetic as present in the material deposited under ATCC No. 12345 and flanked by the molecular markers A1 and A2.

[34] Independent developments are those made without utilizing the patentee's material or information.

2.2.1 Increasing IP transparency

Based on the common practice to use commercial seed material for further breeding, it is a valid concern of breeders to become "contaminated" with patent material if the patent is not clearly indicated on the bag of commercial seed material. There is currently no legal requirement to declare IP rights and often the presence of a patent trait cannot be detected by an obvious phenotype.

Through something like an industry code of conduct, seed companies could declare all relevant IP rights, both patents and PVP, on commercial seed materials. Such declaration can also be made using web-pages.

2.2.2 Breeders exemption in patent laws

Access to well-adapted, well-characterized, and commercially-available germplasm is an important element to help ensure continued progress in breeding. Some breeders are demanding an extension of the PVP "breeders' exemption" to patents.[35] A breeders' exemption, while established in PVP law, does not exist in most patent laws. Germany, France and Switzerland have introduced a limited breeder's exemption, which allows the use of patent material for breeding and development, but in contrast to the PVP breeders' exemption, does not extend to the commercialization of the new variety if it is still within the scope of the patent.[36]

A full breeder's exemption, as requested by the Dutch Breeders' Association Plantum, that allows free commercial use of a patented plants and traits[37], would have the effect of a compensation-free compulsory license. Not only is this in conflict with EU and international laws[38], it would also make patents meaningless.

A breeder's exemption in patent law for plants needs to address two different elements: first, access to the patented traits or sequence as such, and – second – to the genetic background of the plant. The German or French solution treat both elements the same and a competitive breeder can use the genetic background of a plant but also the patented trait or gene as such. Certainly, one patented gene should not block the use of the entire genetic diversity of a plant from further breeding. However, granting a free license to use patented traits for breeding and development causes further erosion of the effective patent term, a term which is already shortened by long regulatory approval times and not compensated by a supplementary patent certificate (SPC) as in other technology areas. [39]

A legal framework to balance access and protection under patent exemptions may have the following elements:

1. ***Access to genetic background:*** *Breeders should be entitled to use a commercialized[40] plant variety containing a patented gene or trait [41] to access the germplasm component of that plant variety to breed, develop, and commercialize a new plant variety without a license provided that the resulting variety does not comprise the patented gene or trait.*

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35 International Seed Federation, 2003, Position: "Therefore ISF considers that a commercially available variety protected only by Breeder's Rights and containing patented elements should remain freely available for further breeding. If a new plant variety, not an essentially derived variety resulting from that further breeding, is outside the scope of the patent's claims, it may be freely exploitable by its developer. On the contrary, if the new developed variety is an essentially derived variety or if it is inside the scope of the patent's claims, a consent from the owner of the initial variety or of the patent must be obtained."

36 DPatG §9 German Patent Law; Article L613-5-3 of the French Intellectual Property Code

37 The Dutch breeders association Plantum requests an unlimited "freedom-to-breed": Breeding with a patented variety should be free as well as commercialising the newly developed variety, even if it still contains a patented trait. (http://www.plantum.nl/pdf/Standpunt_octrooi_kwekersrecht_extended_UK.pdf)

38 TRIPS Article 31(h) requires for compulsory licenses that "the right holder shall be paid adequate remuneration in the circumstances of each case taking into account the economic value of the authorization".

39 An established solution for losses in effective patent term due to regulatory approvals are supplementary protection certificates (SPC), which are available for pharmaceuticals (Reg.No. 1768/92/EC) and crop protection products (Reg.No 1610/96/EC).

40 A commercialized variety implies lawful access, i.e., the material cannot be obtained from trials or other sources without the authorization of the patentee. This limitation follows the consideration that a breeder's exemption under the patent law should not go beyond the exemption in the PVO law, which is de facto limited to the use of commercial material.

41 Exceptions may exist in the US where the germplasm as such can be subject of a patent.

2. ***Access to patented traits and genes:*** *Breeding and development with a patented trait or gene should be permissible without a license until obtaining of a PVP right for the new variety.* [42]

3. ***Patent term extension for regulated traits:*** *As a necessary compensation for the eroding effect of a breeders exemption and regulatory delays, traits which are regulated as genetically modified or novel food should be entitled to a patent term extension.*[43] *Native traits, which do not require such a approval, would not be entitled to a term extension. While this would cause patent term erosion, it seems acceptable. In view of shorter development times, native traits in general have an effective patent term of more than 15 years and would – even if the current SPC regulations would be applicable - only exceptionally be entitled to an SPC.*

Such framework seems balanced and progressive: breeders have free access to the genetic background of a plant, so concerns regarding patents limiting access to genetic diversity are eliminated. Further, breeders can conduct breeding until establishing an own IP right. That provides the base for negotiating a cross-license or compulsory licensing.[44] Since adapting the patent laws in numerous countries can be a very lengthy and cumbersome effort, the above rights (with the exception of a patent term extension), can also be established in form of an industry-led solution e.g., by a non-assert for a free access of the genetic background.

2.2.3 Facilitated technology access through industry-led solutions

Adapting the legislative framework for IP is a necessary, but potentially insufficient requirement to ensure the creation and broad dissemination of breeding innovations. Innovative technology licensing and collaboration strategies are necessary.

2.2.3.1 Industry licensing platforms

Licenses can be difficult to negotiate – especially for small breeders without legal resources. For traits which do not require complex regulatory, stewardship and liability provisions (as required for GM traits) facilitated licensing arrangements can be envisioned. A company or industry-led license platform can prove “free access but not access for free” under standardized, fair reasonable and non-discriminatory (FRAND) terms. To avoid tactical games and ensure a high use rate in the industry some governance rules might be helpful:

(i) A “pull-in” mechanism requires licensees to make own patents available under same framework[45];

(ii) An arbitration mechanism allows for fast dispute mediation on prices[46];

From an economic point licensing platforms make sense, also for larger players, especially from technologies with moderate value and shorter lifecycle like native traits: While some tactical elements in license negotiation may be lost, income from technology can be maximized at low trans-

[42] As for PVP, breeding with patented materials should start from legally obtained commercial material. As for PVP, development should not include acts like production or reproduction (multiplication), conditioning for the purpose of propagation, offering for sale, selling or other marketing, exporting, importing, stocking for any of the purposes above, or other commercial activities such as trials for promotion or marketing purpose. In addition the competitive breeder has to accept full responsibility and liability for compliance with all laws and regulations applicable to regulated genes and traits.

[43] The extension should apply only for the subject of the authorization and only for a period up to 5 years.

[44] The Biopatent Directive introduces a modified compulsory license regulation for inter-dependent PVP rights and patents Art. 12 Biopatent Directive. A compulsory license can be granted if the owner of the dependent right has applied unsuccessfully to the patentee for a contractual license, and where the plant variety constitutes significant technical progress of considerable economic interest. A public interest is not necessary.

[45] A licensee has to make own patent for “native traits” available also under fair and reasonable conditions..

[46] A very efficient mechanism can be baseball arbitration or pendulum Arbitration, a determination where an arbitrator has to resolve a dispute between two parties (licensee and licensor) by making a determination of which of the two sides has the more reasonable position. The arbitrator must choose only between the two options, and cannot split the difference or select an alternative position. Taking an unreasonable position imposes a high risk that the other party’s position is adapted, a procedure which normally results in position which are very close to each other.

actional costs. For competition law reason, bilateral licenses always have to remain available and breeders can elect not to use a facilitated licensing mechanism is desired.

2.2.3.2 Public-private partnerships and cooperative networks

In general, no single entity has the expertise and capabilities to provide all of the innovations needed to meet farmers' needs and address growing global challenges. It is clear that the world's farmers face unprecedented challenges that can only be met with integrated solutions that combine high quality seeds, modern crop protection and resource saving agricultural technologies. The quality seed will require a combination of superior germplasm and different input and output traits. Developing such products in an economic and efficient way will require collaborative approaches.

Collaborative public-private partnerships are a key mechanism to bridge the gap between public and private sectors' distinctive competencies. For national governments, universities and public research institutes, partnerships offer a way to translate shared research outputs into useful, relevant tools for poor farmers or humanitarian purposes. IP frameworks must enable and foster knowledge sharing in order to allow partnerships to develop and be effective. Previous approaches were either preventing patent protection to ensure freedom-to-operate[47], granted exclusive rights to one commercial party, or providing a donation to the public[48]. These approaches underutilized the potential of the first "seedling" innovation to create a sustainably growing knowledge pool.

"Open-source" can make technologies broadly available, but IP is necessary to enable a framework of rules. "Open-source" is different from "freeware" which comes without obligations. Open source models need to be underpinned by strong and enforceable IP rights to enforce compliance with the rules of the common, i.e. that IP-users (licensees) cannot restrict public availability of their improvements.[49] In the software area, these rules are established by copyright, an IP right which is automatically created with the act of creation and without any further need of registration. In the plant-breeding domain, PVP, patents or other IP rights are necessary as a tool to drive and support collaborative networks. As basic rules the following concepts might be useful:

(i) Access to material and information is "open" but comes with rights and obligations;

(ii) If improvements and inventions are made using the material and information, a grant back is made to the consortium. All members of the consortium will have access.

(iii) No grant-back is made to for a commercial use of product specific IP (e.g., PVP rights protecting one variety or patents protecting a specific GM event)

(iv) Innovators, which further improve the "seedling" innovation and provide grant-backs, should have benefits over mere users. Mere users should make financial contributions which are allocated to the innovators and/or used to drive further innovation.

Creative thinking and especially a genuine good will to establish collaborative networks on win-win are pre-requisites to reduce such concepts to practice.

3. Summary and Conclusions

The challenges of meeting the food, feed, and fuel needs of a rapidly growing global population are unprecedented. Food production will have to at least double by mid-century, while avoiding the need for massive forest clearance or significant disruption of other natural habitats. The drive to increase use of renewable raw materials and biofuels will put additional demands on agricultural

[47] Such an approach is chosen for the Cocoa Genome initiative (http://www.cacaogenomedb.org/about). However, these policies are difficult to enforce, especially against third parties which have not signed any agreement with the consortium.

[48] Granted licenses without ensuring a grant-back of improvements will not establish a sustainably growing innovation pool and knowledge sharing. They are rather a one-time effort and do not establish cooperative networks.

[49] For example, it is fundamentally important for the sustainability of the common that parties accessing the technology also return improvements and don't block future innovation. Syngenta provides access to its donated maize genetic stocks under the provision that the recipient shares new information and agrees not to block others. The recipient has to agree not to file patents (but only PVP) or - if legally obliged to file patents - to grant a non-exclusive license. http://www.redorbit.com/news/health/1274061/ syngenta_corn_genetic_stocks_donation_will_accelerate_research_from_genome/index.html

productivity, which cannot fully be met by the traditional approach of gradual improvement of varieties. The global challenge to produce “more with less” requires adaptation of and heavy investments in modern plant biotechnology and advanced breeding techniques.

This necessary technification of plant breeding will continue to drive change and consolidation in the seed industry. Defensive strategies based on abandoning of IP regimes are risky and potentially shortsighted. “IP bashing” has become a fashionable trend of many NGOs and politicians rarely miss an opportunity to criticize IP, alleging that it has become an obstacle to innovation, rather than its base and foundation. “Open source”, “knowledge sharing”, “Freedom of information” are buzzwords to argue for abandonment of the current IP framework. This can become dangerous: while the patent system has proven to foster innovation, the claim that its abandonment can provide for an even stronger flow of new technologies is not supported by any evidence. Most arguments conveniently ignore that today’s knowledge-based society is based in a large part on the knowledge-sharing incentives provided by the patent system. An inventor, as part of the “deal” with the society shares his invention and discloses his knowledge against a time-limited exclusivity. If the incentive of the patent system is taken away, innovators would likely return to trade secrets, which would actually reverse knowledge sharing.

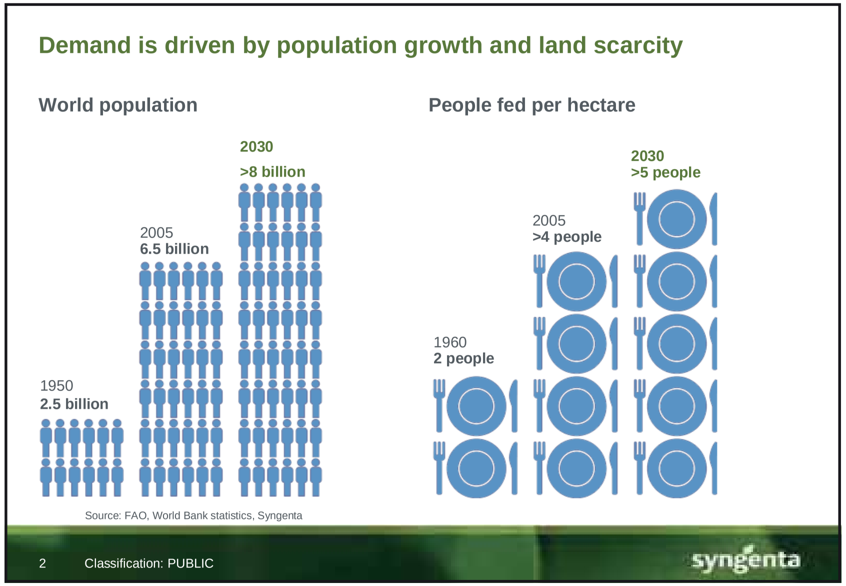
A successful innovation initiative may benefit from two elements: first, a mechanism to maximize the creation of innovation by providing robust and balanced IP incentive systems. And second, a mechanism to maximize the impact of innovations by facilitating technology dissemination, licensing, and collaboration. The second step will not work without the first: creation comes always prior to sharing.

A sincere effort to tackle the innovation need in agriculture can only be made by consolidated efforts of all stakeholders, including legislators and technology developers, in order to find creative ways to leverage invention not primarily by blocking others but by making them accessible.[50] Only through such an alliance can the current perception of “No Patents on Life”[51] change to “More Patents for Life” and support the positive impact IP can have on innovation for the benefit of all.

[50] Because plant related inventions need to be commercialized in locally adapted germplasm, no single company can provide global coverage. Seed companies in general license their traits on a broad base. A trend which needs further promotion.

[51] The „patent on life“ slogan alleges that a patent grants ownership to life, a myth based on a fundamental misunderstanding of the patent system. First, the concept of life is unpatentable. At a maximum certain genes, traits, and elements isolated from living organism can be patented. Even if a patent claim „covers“ a living organism, it grants no ownership rights but merely the right to exclude others to practice the invention. Civil law ownership rights to animal and plants are much more „rights on live“ and essentially undisputed.


syngenta
Intellectual Property and Technology Transfer New Approaches
Michael A. Kock
„How the Private and the Public Sector Use IP to Enhance Agricultural Productivity"
WIPO Seminar, Geneva, June 14, 2011


Demand is driven by population growth and land scarcity
World population
1950
2.5 billion
2005
6.5 billion
2030
>8 billion
People fed per hectare
1960
2 people
2005
>4 people
2030
>5 people
Source: FAO, World Bank statistics, Syngenta
2
Classification: PUBLIC
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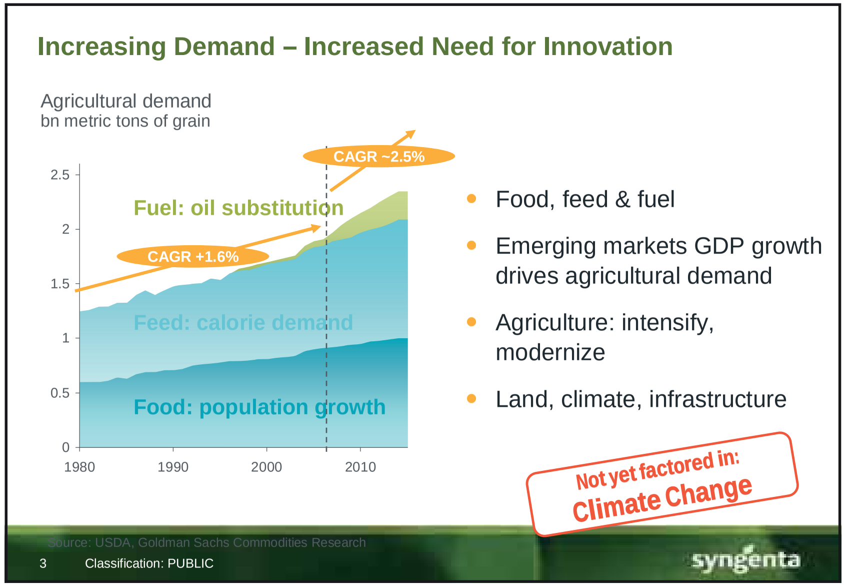
Increasing Demand – Increased Need for Innovation
Agricultural demand
bn metric tons of grain
2.5
2
1.5
1
0.5
0
1980
1990
2000
2010
CAGR ~2.5%
CAGR +1.6%
Fuel: oil substitution
Feed: calorie demand
Food: population growth
Food, feed & fuel
Emerging markets GDP growth drives agricultural demand
Agriculture: intensify, modernize
Land, climate, infrastructure
Not yet factored in:
Climate Change
Source: USDA, Goldman Sachs Commodities Research
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Classification: PUBLIC
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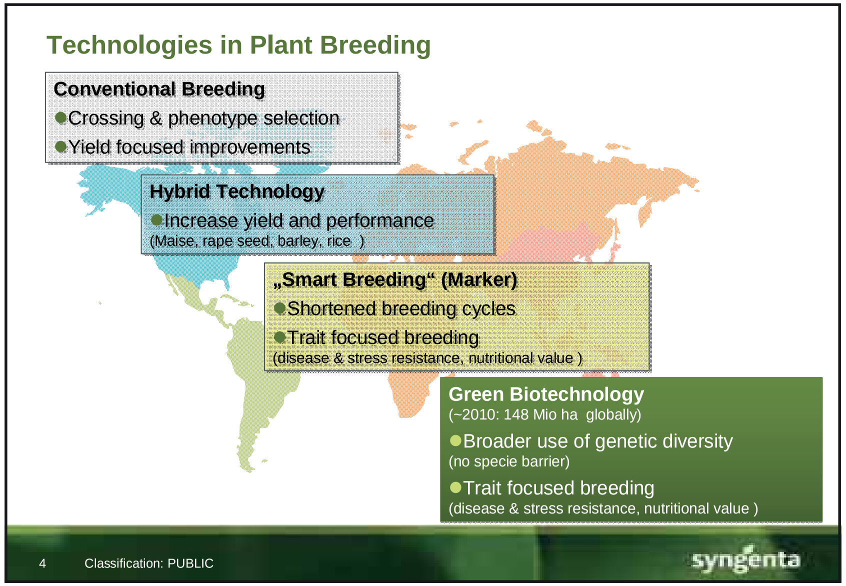
Technologies in Plant Breeding
Conventional Breeding
Crossing & phenotype selection
Yield focused improvements
Hybrid Technology
Increase yield and performance
(Maise, rape seed, barley, rice)
„Smart Breeding" (Marker)
Shortened breeding cycles
Trait focused breeding
(disease & stress resistance, nutritional value)
Green Biotechnology
(~2010: 148 Mio ha globally)
Broader use of genetic diversity
(no specie barrier)
Trait focused breeding
(disease & stress resistance, nutritional value)
4
Classification: PUBLIC
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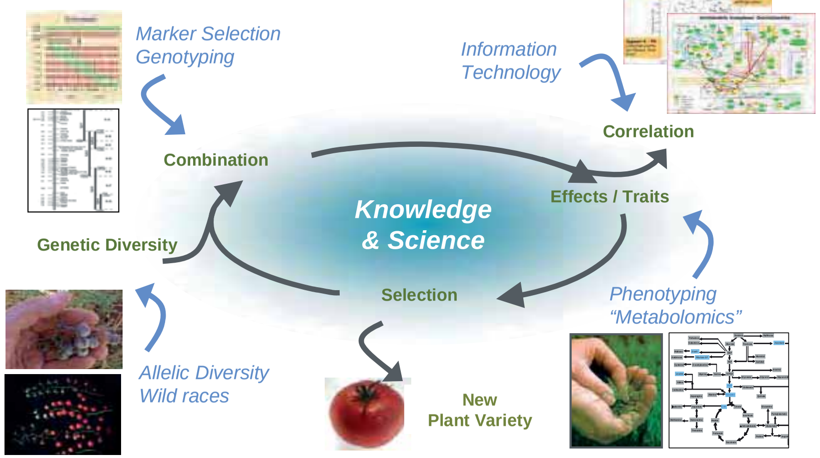
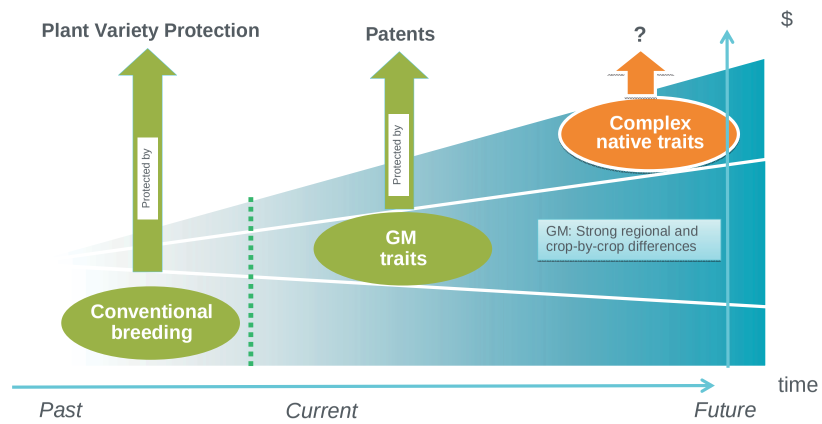
Modern Breeding Research
Technology integration for improved, faster product developmentlung



The IP tool kit: patentability of agro-innovations
Large heterogeneity: Uncertainty for new areas



Success Factor: Intellectual Property Environment
Dependency of the Seed Industry on IP

What does seed and software industry have in common ?

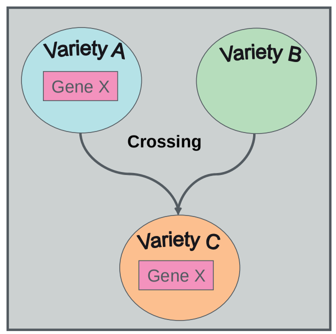
Seed is a high-tech product in an easy to copy form

IP is necessary to prevent "unfair" copying

IP regimes:

- Plant variety protection
- Patents

Plant variety protection vs. Patents
Why we need both



Only variety protection for variety A:
- **Requires:** Commercial novelty, distinctiveness
- **Term:** 25-30 yrs from grant
- Competitors can use variety A without a license for breeding
- New variety C can be freely commercialized

→ **Efficient protection for variety A genetics**
→ **No efficient protection for gene X**

Patent for Gene X:
- **Requires:** Absolute novelty, inventiveness
- **Term:** 20 yrs from filing
- Competitor can use variety A for research (in some countries also breeding)
- Commercial use of variety C with the patent gene requires a license
- EU: Farm-save-seed is harmonized with PVP law

→ **Efficient protection of gene X**
→ **No efficient protection for variety A genetics**

Criticism on IP ...
IP stands in the way of innovation

"There are limits that we should not cross. Farmers and breeders should not be handcuffed by biological patents"
Germany's Minister of Food, Agriculture and Consumer Protection Ilse Aigner

Patent blockings and the anti-commons problem are notable in hindering access to breeding material and the use in breeding of established knowledge.
Advisory Board on Biodiversity and Genetic Resources at the Federal Ministry of Food, Agriculture and Consumer Protection

States have to *"[e]nsure that protection of patent-holders or plant breeders' rights does not discourage innovation. In particular, States should not allow patents on plants.*
UN Special Raporteur on the Rigth to Food, Olivier de Schutter

Praise on IP ...
IP fosters innovation

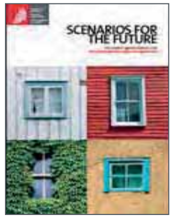
To foster competitiveness and innovation in this field, the Commission calls for better co-ordinated [...] effective intellectual property rights regime in Europe.
EU Commission, Lisbon Startegy on Biotechnology

Intellectual property (IP) protection is therefore afforded to plant breeders as an incentive for the development of new varieties to contribute to sustainable progress in agriculture, horticulture and forestry.
UPOV, Aug. 2006 Biotechnology

The only way that we know to create the incentives, to have people take money and labor [...] and put it into a risky development is to provide the intellectual property protection.
Rob Shapiro, Chair of EcoIDEA; Earth day 2009

A unbridgeable contradiction ?

A changing IP environment: Outlook 2025



2007 Study of the European Patent Office
Patent system 2025 - most likely scenario

•Open source: Society is against IP as perceived threat to human needs (health, knowledge, food, and entertainment)

•Lack of societal trust and growing criticism of the IP system result in its erosion

In a world developing in a knowledge-based society ...

- „Open source" is positively perceived
- Cooperation drives faster solutions
- Networks determine success
- Know-how exchange is facilitated & enforced
- Integrated offers succeed

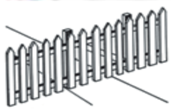
- IP is perceived roadblock for innovation
- Exclusive rights are negatively perceived
- Trade secrets become difficult to keep
- Traditional IP strategies start to fail
- Anti-trust scrutiny increases

IP as a tool

IP is a tool.
A tool is as such neither good nor bad,
A tool can be used in a beneficial or problematic way.

Beneficial use
- Licensing, technology dissemination, benefit sharing
- Enables "open innovation"

Beneficial effects
- Encourages innovation & R&D investment
- Encourages knowledge sharing



Problematic use
- Monopolistic / anticompetitive use ("trolls")

Problematic effects
- Can block innovation (if without research exemption)
- Can increase transactional & legal costs

Can we minimize the problematic effects without losing the benefits ?

Benefits of robust patent system

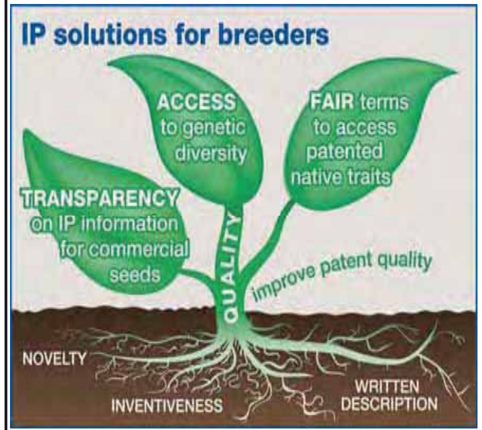
- **Innovation Culture:** Patents foster innovation in all technology fields
  - Breeding inventions are technical and worth of incentives as other technology
  - Plants developed with modern („smart") breeding are valuable alternatives to green biotechnology. Their agronomic value is not lower.
- **Knowledge Society:** Patents require and foster disclosure and knowledge sharing
  - Denial of patents „forces" breeders to use trade secrets as last resort to protect their innovations. Will this slow innovation cycles ?
  - Is an industry based on secrets (i.e., without patents) more competitive ? (see software industry)
  - How can SME and academics leverage their innovation without patents ? (Impact on licensing models)
- **Investment Culture:** Availability of patents influence R&D investment
  - Reduced investment in research and preservation of genetic diversity
  - Preferential investment into patentable technology (chemistry, GM)

Optimizing IP use
Common objectives

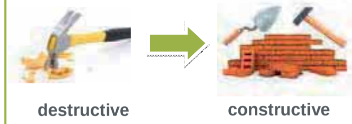
„No IP“ can be problematic:
- Encourages secrets (everlasting)
- Facilitates copying and free-riding (for self-disclosing innovations)
- Takes away a mechanism to prevent misappropriation

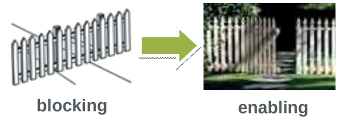
How do we use IP as a tool to
- ➢ disseminate knowledge & innovation to speed-up innovation cycles ?
- ➢ encourage collaboration and open innovation?
- ➢ build a sustainably growing knowledge and innovation pool?
- ➢ enable fair access and benefit sharing and prevent unfair „free riding“ ?
- ➢ prevent IP misappropriation and FTO constrains ?

Optimizing IP use
Elements of a Solution

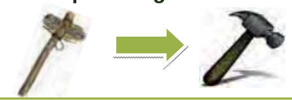


Optimizing the tool's use



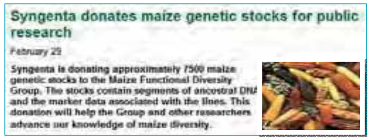


Optimizing the tool



Optimizing IP use
Examples

1. **Open-source**



2. **Licensing platforms**

3. **Open innovation initiatives**

Optimizing IP use
Open source models

Syngenta donates maize genetic stocks for public research

February 29

Syngenta is donating approximately 7500 maize genetic stocks to the Maize Functional Diversity Group. The stocks contain segments of ancestral DNA and the marker data associated with the lines. This donation will help the Group and other researchers advance our knowledge of maize diversity.

What Open Source needs in a "Patent World"
- Access & Control
- Benefit capture, value sharing
- Incentives to innovate (give'n take)
- Consent not to "block" further innovation

Optimizing IP use
Industry licensing platform

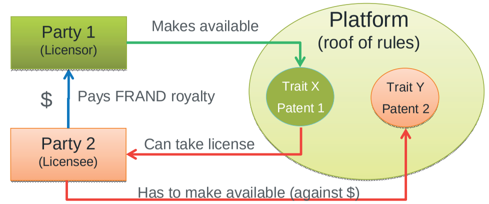
Licensing Platform: A system based on incentives („carrots“) and obligations („sticks”)

Free access ≠ access without rules
Free access ≠ access for free

- ➢ Free use for R&D and breeding; free use of genetic background
- ➢ Fair remuneration for commercialization (FRAND)
- ➢ Low transactional costs
- ➢ Pull-in mechanism for licensee’s related IP to grow the pool

Optimizing IP use
Industry licensing platform

- Platform for facilitated FRAND access to non-regulated traits
  (bi-lateral licenses remain available at any time)
- FRAND-based royalty upon commercialization; free use for R&D
  (dispute mediation / arbitration offered by the Platform)
- Pull-in mechanism: Parties who access technology have to make own technologies accessible incl. improvements



Optimizing IP Use
Open innovation platform for public private partnerships

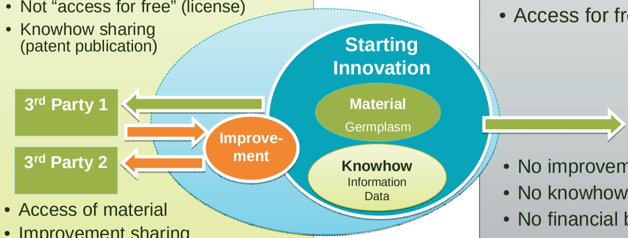
Open innovation platform: A system based on incentives („carrots“) and obligations („sticks”)

- ➢ Free (but not unregulated) access of background IP
- ➢ Non exclusive grant-back of “improvement IP”
- ➢ Exclusive ownership for product specific IP (PVP, event patent)
- ➢ Free use for R&D, public partners and in developing countries
- ➢ Remuneration for commercial use in developed markets
- ➢ Incentives for contributing innovators (e.g., lower payments)

Open innovation platforms
The importance of an IP basis

The „Patent“ Scenario

- Free access of material and knowhow
- Not “access for free” (license)
- Knowhow sharing (patent publication)



- Access of material
- Improvement sharing
- Benefit sharing
- ➢ Network creation
- ➢ Faster innovation cycle

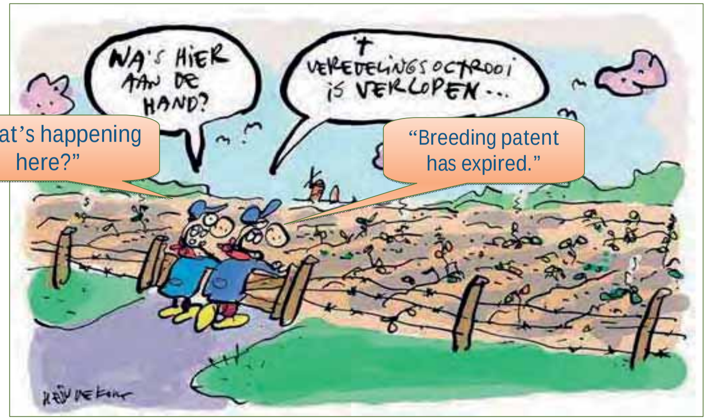
The „No Patent“ Scenario

- Free access of material and knowhow
- Access for free
- No improvement sharing
- No knowhow sharing (secrets)
- No financial benefit sharing
- ➢ No network creation
- ➢ Slower innovation cycle
- ➢ Double work

Conclusions

- IP systems – PVP and patents – are important incentive systems to foster agricultural innovation.
- An erosion or abandonment of the IP systems will
  - reduce the incentive of innovation and investment
  - result in more secrets and thereby slow innovation cycle
- While some improvements to the IP systems are possible, improvements and creative ideas for the use of IP are more important:
  - Increase technology dissemination
  - Increase benefit sharing
  - Increase speed of innovation cycles
  - Increase cooperation and networks (integrated solutions)

If breeding patents are abandoned …



http://www.fd.nl/artikel/22177311/houd-octrooi-plantveredeling-ere

Thank you very much !

Bringing plant potential to life

The role of IP for successful Plant Breeding and for the availability of New Plant Varieties to the Farmer

Marcel Bruins,
Secretary General of the International Seed Federation (ISF)

Summary

Plant Breeding has provided an enormous contribution to global agriculture. Yield increase in many crops has been 1-3 % per year. A large proportion (50-90%) is the result of improved varieties, rather than of other input factors. The efforts of plant breeders have also lead to varieties with increased resistance to biotic stresses, saving many millions of dollars in crop protection products per year and saving millions of liters of diesel. It has also lead to varieties with increased tolerance to abiotic stress, such as drought, salt, flood or herbicides.
Plant breeding is an activity that requires a considerable amount of skill and financial investments to support the lengthy and risky processes of research and product development, and mechanisms should be in place to recoup the return on investment, such as intellectual property (IP), which is crucial for a sustainable contribution of plant breeding and seed supply.
ISF members are unanimously in favor of a strong and effective IP as it ensures an acceptable return on research investment, and it is a prerequisite to encourage further research efforts. As such it is the motor of innovation. Innovation is absolutely critical to meet the challenges that mankind has to face such as food security, population growth, climate change or water and fuel shortage, to name a few. Analyses comparing crop biology and other tools, which differ per crop, indicate that stronger IP systems leads to more innovation. Farm Saved Seed and its suboptimal implementation contribute to less return on investment and lower yield gains.
With a weak or no IP system in place, innovation in this sector would be seriously hampered and the availability of new and improved varieties to farmers would decrease significantly.

Introduction

In the first decades of the 20th century seed traders felt a clear need to establish harmonized trade rules, and this led to the establishment of the International Seed Trade Federation (FIS) in 1924. The desire to protect the fruits of their labour led plant breeders to form the International Association of Plant Breeders (ASSINSEL) in 1938. The International Seed Federation was formed in 2002 by a merger of the FIS and ASSINSEL.

The ISF has its offices in Nyon, Switzerland and has currently 228 members in 78 countries. It is collecting the seed import and seed export data from the World Customs Organization and from those data we know that around 96% of the international seed trade takes place in countries with ISF members. The global seed market is estimated to be around 42 billion USD, with an additional rough estimate for farm saved seed of around 15 billion USD.

International Seed Trade

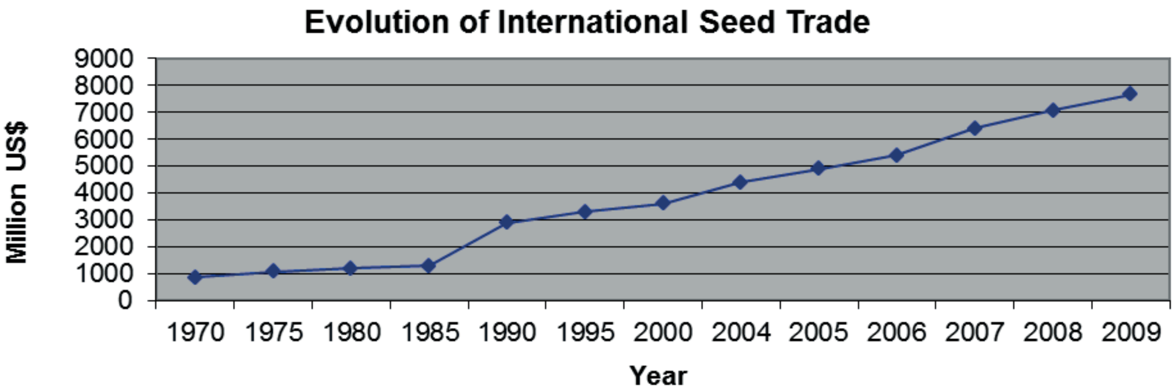
The international trade in seed has grown from a little less than 1 billion USD in 1970 to around 7.6 billion USD in 2009 and keeps growing with about 0.5 to 1 billion per year (see also fig. 1). More and more seed is being moved across borders and the main factors causing this increase are:

- Transportation costs have become cheaper and faster, which allows the seed industry to take advantage of favourable climatic zones such as the East African plains and Idaho for bean, or the high plains of Central and South America for flowers.
- Also the development of hybrid varieties has led to an increase in more seeds moving across borders. Production of hybrid seeds needs specific conditions both in terms of skilled labour and agro-climatic conditions. For example the flowering time difference between male and female maize hybrids require specific climatic conditions, the production of hybrid vegetables requires skilled labour at a reasonable price. Thus the production of hybrid maize in Europe is mainly

located in France, Hungary and Austria, of hybrid vegetables in South East Asia, monogerm sugar beet in France, Italy and Oregon, just to name a few examples.

- And last but not least, there is a higher speed of breeding and other commercial processes, leading to the development of counter season production in other hemispheres.

More information on these topics can be found in the ISF article at www.worldseedconference.org



Source: International Seed Federation (ISF)
www.worldseed.org

Figure 1: Growth of the International Seed Trade

Plant Breeding

Broadly speaking plant breeding could be considered as the changing of the genetic make-up of plants for the benefit of humankind. More specifically, it is developing new varieties through the creation of new genetic diversity by reassembling existing diversity with the aid of special techniques and technologies.

The precursor to plant breeding as we know it today began 9,000 – 11,000 years ago when man domesticated wild plants. By a process of trial and error, plants with desirable traits were selected – the process often referred to as domestication – rendering them more suitable for agriculture (fig. 2). Within a relatively short time frame of several thousand years, all the major cereal grains, legumes, and root crops were domesticated. These were the food crops that the mankind depended on most for their calories and protein.

Figure 2: Examples of domestication. (Source, Crispeels, 2008)

Since then there have been many noteworthy break-throughs in plant breeding, and promising research activities to raise yields in marginal production environments are ongoing. Today plant breeding uses techniques from simple selection to complex molecular methods to integrate desirable traits into existing varieties to meet human needs. Regardless whether carried out by public or private sector, plant breeding is an activity that requires skill and financial investments to support the lengthy and risky processes of research and product development.

Contributions of Plant Breeding

The contributions of Plant Breeding have been numerous and plant breeders throughout the years have focused on increasing the yield of varieties, on resistance to biotic stress and tolerance to abiotic stress. Other factors among others that have been changed to the benefit of mankind are: earliness, taste, size, nutritional and crop quality, firmness, shelf-life, plant type, labour cost and harvestability, just to name a few. It is mainly the plant breeders who, along with other agricultural researchers and extensionists, have provided the world's population with plentiful food, improved health and nutrition, and beautiful landscapes. Agriculture can be considered the foundation of civilization, and in a similar way, plant breeding can be considered the foundation of agriculture.

Yield

Arguably the most important of all characteristics is yield. Studies in different crops over many years show that yield has increased with 1% to 3% per year. At first sight 1% per year may not seem much, but when combined over many years this is surely a significant contribution. Over the past 30 years, in irrigated wheat a yield increase of about 1% per year has been achieved, which can be compared to an increase of around 100 kg per ha. per year (Pingali and Rajaram, 1999).
This yield increase is not restricted to developed countries only. FAO data indicate that for all developing countries, wheat yields rose by 208% (fig. 3) from 1960 to 2000; rice yields rose 109%; maize yields rose 157%; potato yields rose 78%; and cassava yields rose 36% (FAOSTAT).

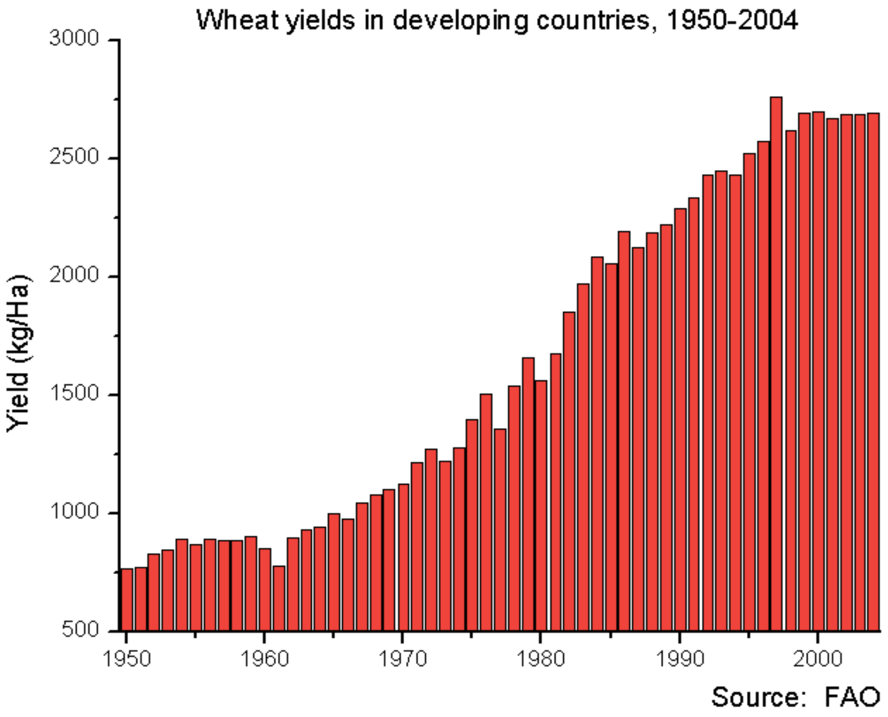


Figure 3: Wheat yields in developing countries, 1950-2004

Winter wheat yields in the UK have more than trebled over the past 60 years from around 2.5 tonnes/ha in the mid-1940s to 8 tonnes/ha today. To determine the effect of the genetic improvements on the total yield increase, the National Institute of Agricultural Botany (NIAB) in the UK carried out a study in 2008 in which 300 varieties of wheat, barley and oats were analysed in 3600 trials, leading to 53.000 data points. Previous studies had already indicated that in the period 1947 to 1986 about half of the increase in yield could be attributed to plant breeding. The rest of the increase was due to improvements in fertilizer, crop protection products and machinery. The 2008 analysis revealed that in the period since 1982 till 2007 in which yields went up from 5-6 tonnes/ha to 8 tonnes/ha, over 90% of all yield increase could be attributed to the introduction of new varieties (NIAB, 2008). This clearly shows the contribution of the genetic component in yield increase.

Land spared

Because yield has increased steadily over the years, Plant Breeders have contributed to a saving of the land which otherwise would have been needed to achieve the same amount of production.
As an example: India's cereal production has increased from 87 million tonnes in 1961 to 200 million tonnes in 1992, but on an arable land base that has remained almost constant, and in that way has helped to limit the extension of cereal cultivation on to other lands (fig. 4). On a global level, between 1950 to 2001, the population grew from 2.5 billion to 5.5 billion, but in spite of that, the area of land devoted to agriculture remained stable at more or less 1.4 billion hectares. It is calculated that on a global level 26 million square kilometers of land did not have to be devoted to feeding the current population, and this will certainly increase in the coming period (CLI, 2001). With that deforestation is decreased and biodiversity maintained.

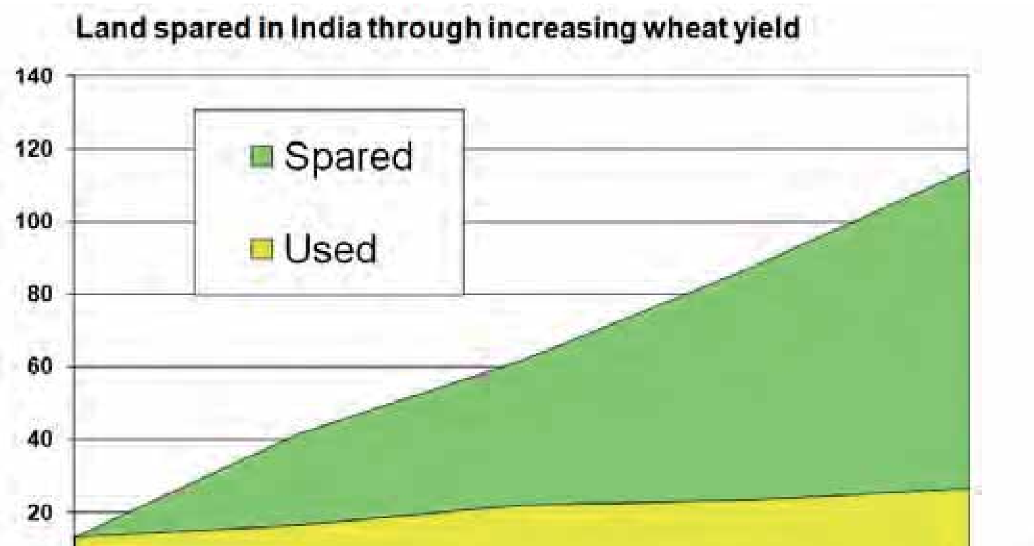


Fig. 4 Amount of land spared in India in millions of hectares in the period 1959-2000.

Biotic stress resistance

According to FAO data, the current annual amount that is lost on a global level due to pathogens is estimated at 85 billion USD and due to insects at 46 billion USD. Therefore it is not surprising that a considerable amount of breeding effort goes into breeding for biotic stress resistance. This involves resistances against fungi, bacteria, nematodes, viruses, water moulds and insects among others. Over the many years breeders have released thousands of varieties with as many or more resistances. In that way they have given the farmers the necessary harvest security to make sure that there would be a crop to harvest at the end of the growing season.

With all these resistances, there was a significantly lower need to use crop protection products, allowing a significant decrease in the environmental footprint of agriculture. It has been calculated that in the UK alone, diseases resistances save 100 million British Pounds per year on crop protection products (BSPB, 2009).
But it should also be said that there is still a lot of work to do. For example fully resistant varieties are still needed for three fungus diseases on cereals and grasses: Fusarium Head Blight (FHB), Ergot and Stem Rust. It is estimated that FHB is causing yearly 1 billion USD in losses in wheat yield and grain quality. Reports indicate that in a state such as North Dakota (USA) alone up to 10 % loss can occur in wheat due to ergot infection, and losses of 5 % are common in rye. With the Ug99 strain of stem rust 100% crop loss has been reported. These are just a few of the examples where the continuous and relentless efforts of plant breeders are desperately needed.

Abiotic stress tolerance
90 million people per year are affected by drought, 106 million people per year are affected by floods and around 900 million hectares of soil are affected by salt. And in addition, according to FAO data, the current annual amount that is lost on a global level due to weeds is a staggering 95 billion USD. Of this, around 70 billion USD is lost in developing countries. This amount is equivalent to a loss of 380 million tonnes of wheat.
So plant breeders have also worked on tolerance to abiotic stress factors such as herbicide tolerance, drought, flood and salt. In case of poor soils, breeders have attempted to select for varieties which were better capable of taking up the necessary nutrients. When talking about the possible effects of climate change it is mentioned that certain areas are expected to have a decrease in the level of rainfall, whereas other areas could expect higher levels of precipitation. Plant breeders will continue to search in and create new genetic variation to develop germplasm that will be able to cope with these challenges.
The numbers above more than anything else underline the task ahead and the need to have a good plant breeding infrastructure and seed industry in place.

Responding to the challenges
Regarding all these contributions above it is safe to say that Plant Breeding has increased food security, in different ways, and with that contributed to hunger and poverty alleviation and to a better nutritional value. Resistant varieties have led to a reduction in the use of crop protection products and a reduction in the use of fossil fuels. With certain varieties there is no or less need for ploughing so this has decreased CO2 emissions and has conserved the soil and its water content. Increased yields have decreased the need for more land to be brought into agriculture, and has decreased deforestation. This in turn has contributed to a conservation of biodiversity and a better carbon sequestration. All in all, improved varieties lead to an improved economic functioning and enhanced social stability. But all these contributions need Investments and also Return on Investments.

ISF View on Intellectual Property

ISF members are in favor of a strong and effective intellectual property protection which is necessary to ensure an acceptable return on research investment. It is considered to be a prerequisite to encourage more research efforts, a motor for further innovation. IP is essential to meet the challenges mankind has to face in the coming years, i.e. feeding an increasing population whilst preserving the planet. All of these endeavors require substantial, long-term and high risk investments.

In almost all countries, where plant varieties are protectable, a UPOV or UPOV-like system is available. There are a few countries where protection through utility patents is also possible and ISF considers that both systems are legitimate. If a country envisages the adoption of a *sui generis* system to protect plant varieties ISF recommends that this *sui generis* system, as a minimum, conforms to the requirements of the 1991 Act of the UPOV Convention (ISF, 2009).

ISF members also consider that Breeder's Rights (and patents for plant varieties where allowed by law) and patent protection for biotechnological inventions, are efficient protection systems. It is thus necessary to define a fair coexistence of the two rights. The introduction of the concepts of essential derivation and dependency in the 1991 Act of the UPOV Convention is a welcome initiative to bridge the two systems, in the interest of all the actors involved.

ISF is however convinced that there is substantial room for improvement in terms of speed and quality of patent examination, opposition and litigation procedures and is concerned that the costs involved in these procedures are often detrimental to the quality and enforceability of patents in general. ISF therefore urges governments to give the necessary means in terms of human resources and skills to the patent offices and courts. ISF is also in favor of complete transparency at all steps of the patent examination by giving to anybody a full and instant access to the examination file.

One of the items that should be improved is that fact that hybrid varieties by some patent offices are not considered as varieties, whereas such hybrid varieties do fall within the definition of a variety as approved by UPOV.

Co-existence of Breeders Rights and Patents

Further clarification is needed as regards the use of biotech varieties containing patented elements and protected by Breeder's Right for further breeding. ISF members are strongly attached to the breeder's exception provided for in the UPOV Convention and have expressed their concern that the extension of the protection of a gene sequence to the relevant plant variety itself could extinguish this exception.
Therefore ISF members consider that a commercially available variety protected only by Breeder's Rights and containing patented elements should remain freely available for further breeding.

If a new plant variety, not an essentially derived variety resulting from that further breeding, is outside the scope of the patent's claims, it may be freely exploitable by its developer. On the contrary, if the new developed variety is an EDV or if it is inside the scope of the patent's claims, consent from the owner of the initial variety or of the patent must be obtained (ISF, 2009).

France, Germany and Switzerland have already introduced such an 'extended Research Exemption' into their patent laws, and The Netherlands have recently decided similarly. The ISF position has played a major role in the political discussions.

The expiry of biotech patents is a relatively new phenomenon to which the regulatory aspects create the need for an in-depth study of the consequences.

Capturing value of plant breeding worldwide

As an example a comparison between wheat and maize has been made at a global level. We see in fig. 5 that the research expenditures on maize are about ten times higher than for wheat. One of the reasons is that hybrid varieties in maize are on the market since 1921, whereas wheat is still marketed mainly as a self-pollinated crop. This makes it very easy for others to reproduce a wheat variety as such and to create a very similar variety without much research investments. This is decreasing the possibilities for the breeder to recoup some of the investments that were made in creating the original variety. This is further exacerbated in case the farm saved seed regulations are not adequately implemented, which is the case in many countries.

	Wheat	Maize
Global acreage (mio ha)	225	160
Research expenditure (mio US$)	735	5100
Research expenditure (US$ / ha)	3.3	32

Figure 5: Comparison of wheat and maize in terms of acreage and research expenditure.

A factor that is also playing a role is that for maize several biotech traits have been developed, which in many cases have been patented, and this is much less the case for wheat.

A comparison of the yield in tonnes per ha in the US and in the European Union (fig. 6) shows that the yield increase for wheat in the period 1961-2009 has been much slower than for maize, especially so in North America. And this may again be linked to the differences between the two crops as outlined above.

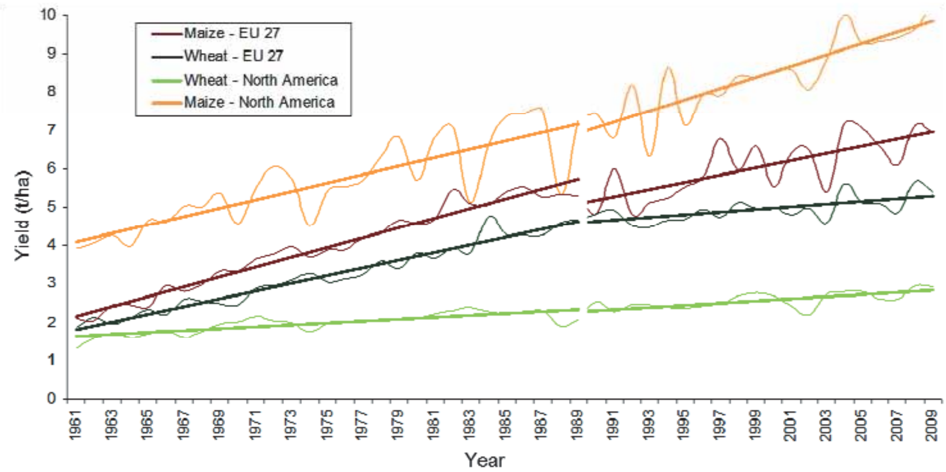


Figure 6: Yield of maize and wheat in North America and the EU-27 (1961 – 2009)

Another example underlining the difference is the amount of harvested area of the two crops in the EU and the USA (fig. 7). We're seeing that the harvested area for wheat and maize in the EU27 is almost constant, but that the wheat area in the USA is decreasing, and the maize area increasing. Maize has become a more profitable crop and farmers and preferring maize over wheat. The higher yield increase in maize over the past decades has certainly contributed to this factor.

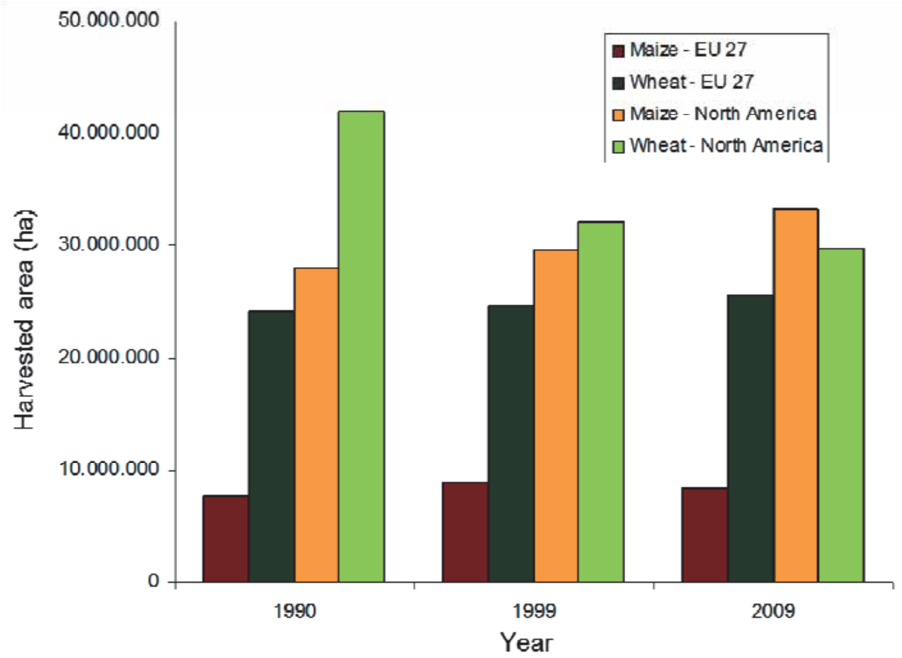


Figure 7: Harvested area of maize and wheat in North America and the EU-27 (1990 – 2009)

To conclude this crop comparison, we see that the worldwide acreage for maize is increasing and for wheat stagnating. There are significantly lower R&D expenditures in wheat than in maize, which is obviously leading to lower yield progress. It is also felt that suboptimal implementation of the Farm Saved Seed provisions is part of problem as it does not provide enough return on investment for the plant breeder. Mechanisms like GMO's and hybrids are additional tools that help assure there is appropriate innovation taking place in a crop.

There are some further observations which need to be made to understand the specific IP needs of the seed industry. A first observation is that the global genetic progress must be made as quickly as possible, in light of the huge challenges that we are faced with. For the plant breeder's community it is necessary that there is access to genetic resources and that there is a sufficiently strong framework of Intellectual Property Rights. In contrast to most other inventions, plant varieties cannot be created from scratch. And when plant breeders start breeding a new variety they often start with elite varieties. Depending on the crop, we see that genetic progress is gradual in the range of 1-2% per year. Furthermore it is clear that both Plant Breeders Rights and Patents are needed

Conclusions

Improved varieties and high quality seeds are basic requirements for a productive agriculture, and Plant Breeding has provided an enormous contribution to global agriculture (Borlaug, 1983). In the recent past it has been mainly the genetic component which has contributed to yield increases, rather than other input factors. Furthermore, Plant Breeding will significantly contribute to the challenges ahead such as food security, hunger alleviation, increasing nutritional values, climate change, water or fuel scarcity etc. There are many tools and traits in the pipeline that will prove to be very necessary for the continued supply of high quality varieties and seeds. But to achieve all of this it is clear the intellectual property is absolutely crucial for a sustainable contribution of plant breeding and seed supply, and to meet the challenges ahead. Intellectual Property provides for a Return on Investment and it is a motor of Innovation. With a weak or no IP system in place, innovation in this sector would be seriously hampered and the availability of new and improved varieties to farmers would decrease significantly.

SEED IS LIFE !

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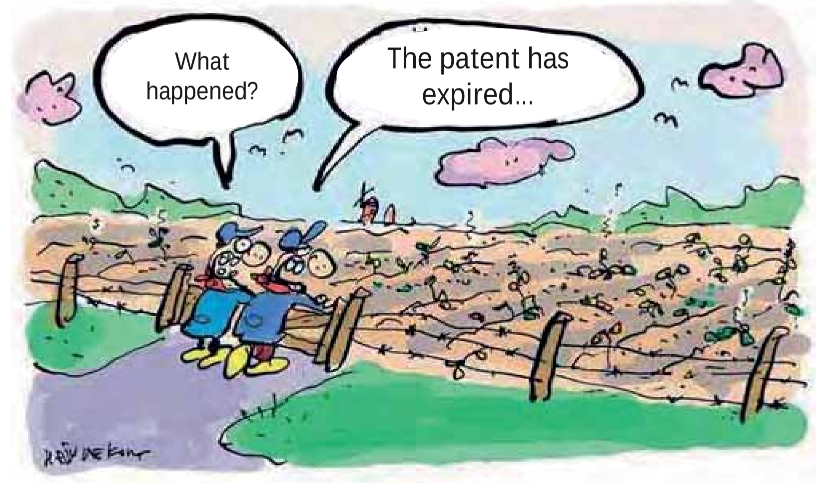
The role of IP for successful Plant Breeding and for the Availability of New Plant Varieties to the Farmer

Marcel Bruins
Secretary-General



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International Seed Federation

(formed by merger of FIS and Assinsel in 2002)

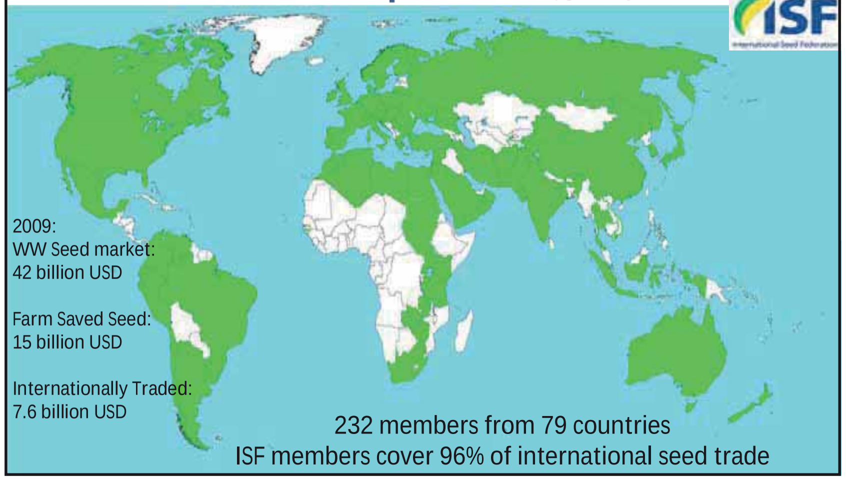
FIS
(international seed traders association)
Established 1924

Assinsel
(international plant breeders association)
Established 1938

Established 2002 -
Secretariat: Nyon, Switzerland (6,5 fte)
For more information:
www.worldseed.org

International Seed Federation

- membership countries (April 2011) -



Growing international seed trade

- Cheap & fast transportation
- Development of hybrid varieties
- Higher speed of breeding & commercial processes
  => counter season breeding and production

For more information: www.worldseedconference.org

Plant Breeding

Changing genetic make-up of plants
for the benefit of humankind

Developing new varieties
→through creation of new genetic diversity
→by reassembling existing diversity
→aid of special techniques & technologies

Precursor:
9.000-11.000 yrs ago
(domestication)

Source: Crispeels, 2008

Contributions of Plant Breeding

- Yield
- Resistance to biotic stress
- Tolerance to abiotic stress

- Earliness
- Taste
- Size
- Quality
- Firmness
- Shelf-Life
- Plant type
- Labour cost
- Harvestability
- Dwarfness

7

Contributions of Plant Breeding
Yield

❑ Winter wheat yields: trebled over the past 60 years
➢2.5 tonnes/ha (mid-1940s) to 8 tonnes/ha today.

❑ NIAB study 2008: wheat, barley, oats
➢300 varieties (>3 yrs), 3600 trials, 53.000 data points

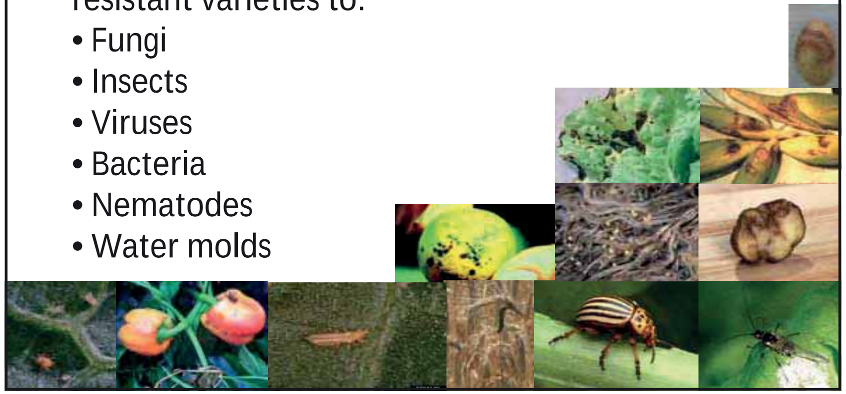
❑ 1947-1986: 50% of increase in yield attributed to plant breeding.
➢Rest to fertilizers, crop protection products, crop husbandry and machinery (Silvey, 1986)

❑ Since 1982: 90% of all yield increase due to introduction of new varieties (yield : 5t/ha =>8t/ha)

8

Contributions of Plant Breeding
Biotic stress resistance

Plant Breeding has provided 10.000s of resistant varieties to:
- Fungi
- Insects
- Viruses
- Bacteria
- Nematodes
- Water molds



Annual global level of lost food production

$85 billion caused by pathogens
$46 billion caused by insects

Source: FAO, Aug. 2009

UK: disease resistance alone saves 100 million GBP/yr in crop protection products

10

Contributions of Plant Breeding
Abiotic stress tolerance

Plant Breeders focus on tolerance for:
- Herbicides (95 billion USD / yr lost on weeds
  - 380 million tonnes of wheat)
- Drought (90 million people affected/yr)
- Flood (106 million people affected /yr)
- Salt (900 million ha affected)
- Better nutrient uptake

Contributions of Plant Breeding

- Food security & Hunger alleviation
- Increase nutritional values
- Reduction of pesticides / fossil fuels
- Reduction GHG emissions
- Land saving / Decrease deforestation
- Conserve biodiversity
- Increase carbon sequestration
- Improved economic functioning
- Enhanced social stability

Needs:
•**Investments**
and
•**Return on investment**

12

ISF View on Intellectual Property

(Antalya, June 2009)

ISF in favor of strong and effective intellectual property protection

⇒Ensures acceptable return on research investment

⇒Prerequisite to encourage further research efforts

  ⇒Motor for further innovation

⇒Essential to meet the challenges mankind has to face

⇒Require substantial, long-term and high-risk investments.

⇒UPOV or patents are both legitimate systems

⇒UPOV 1991 is the minimum

⇒Room for improvement (speed, quality, costs, transparency)

ISF View on Intellectual Property

(Antalya, June 2009)

Coexistence of Breeder's Right and Patents

A commercially available variety (PBR & containing patented elements) should remain freely available for further breeding.

New variety: outside the scope of the patent's claims=> freely exploitable.

New variety: inside the scope of the patent's claims=> consent needed

Patent expiry: New phenomenon (especially of regulated traits)
  => studying consequences

ISF View on Intellectual Property

(Antalya, June 2009)

3. Coexistence of Breeder's Right and Patents

France, Germany and Switzerland have introduced an 'extended Research Exemption' into their patent laws.

Allows breeders to make crosses with the patented plants (=ISF position)

Netherlands recently decided similarly.

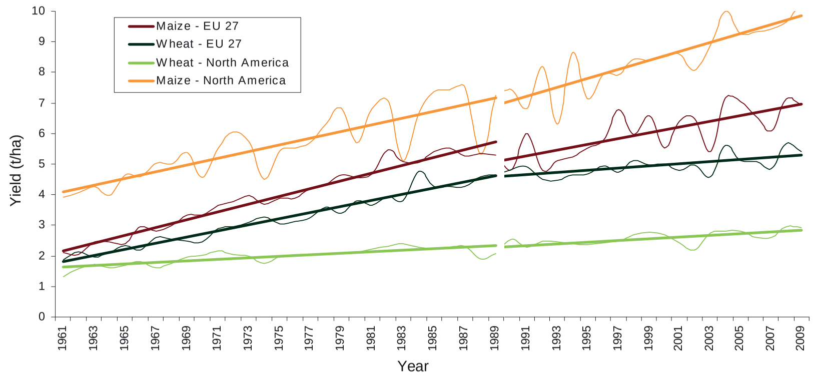
Seeds are special !!

Capturing value of plant breeding worldwide

	Wheat	Maize
Global acreage (mio ha)	225	160
Research expenditure (mio US$)	735	5100
Research expenditure (US$ / ha)	3.3	32

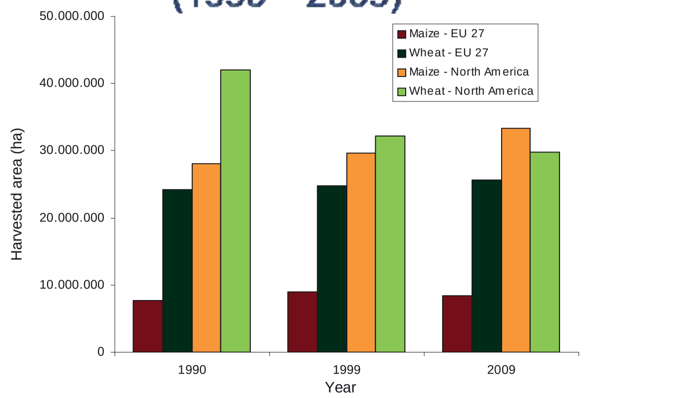
10 times higher R&D expenditures for maize than for wheat → why?

Yield of maize and wheat in North America and the EU-27 (1961 – 2009)



Source: FAOSTAT

Harvested area of maize and wheat in North America and the EU-27 (1990 – 2009)



Source: FAOSTAT

Sub-Conclusions

- Worldwide acreage for maize increasing – for wheat stagnating
- Significantly lower R&D expenditures in wheat than in maize
  - Lower yield progress
- Farm Saved Seed part of problem
- Mechanisms like GMO's and hybrids assure appropriate innovation

→ Is Farm Saved Seed and Innovation a contradiction?

Observations

- Global genetic progress must be made as quickly as possible
- Specific needs of Breeders community:
  - Access to genetic resources and
  - Intellectual Property Rights
- Plant varieties cannot be created from scratch
- Breeding new variety: start with elite varieties
- Genetic progress is gradual (1-2% per year)
- Both Plant Breeders Rights and Patents are needed

Conclusions - general

- Improved varieties and high quality seeds are basic requirements for productive agriculture
- Plant Breeding has provided enormous contribution to global agriculture
- Pl. Br. will sign. contribute to challenges ahead: food security, hunger alleviation, increasing nutritional values
- Many tools and traits in the pipeline that will prove to be very necessary for the continued supply of high quality varieties and seeds

Conclusions – Role of IP

- Intellectual Property protection (both PBR & Patents) is crucial for:
  - A sustainable contribution of plant breeding and seed supply.
  - Meet challenges ahead
- IP provides return on investment
- IP is motor of innovation

Discussion

Transcription of Q&A Dr. Sudhir Kochhar, Dr. Michael Andreas Kock and Dr. Marcel Bruins

Q. – S. Moephuli (ARC): In one of the scenarios you gave an example of Syngenta making available some maize lines. Are these improved maize lines or is it just germplasm that Syngenta has collected all over?

A. – M. Kock (Syngenta AG): It is a mixture of both. It is primarily a germplasm collection with a lot of wild races which we collected over many, many years. Making this available was the first step. But it includes also some improved lines.

Q. – Mrs. Caroline Dommen (Quakers United Nations Office): You spoke about the donation of the maize lines. I wonder whether you considered it doing through the mechanism that was described to us this morning, the Plant Treaty mechanism.

A. – M. Kock: It was a separate effort; it was not under the International Treaty mechanism.

Q. – Mrs. Dommen: I had understood that but I wondered whether you had considered doing it through the International Treaty mechanism. Are those very different mechanisms or are there similarities?

A. – Dr. Kock: Those are different mechanisms. Actually, in that area the International Treaty comes with more obligations and we did not want to have those obligations in place. For instance, we were not expecting any payments.

A. – S. Kochhar (PIU/NAIP/ICAR): The International Treaty obliged to use the Designated Germplasm. This was a set of germplasm which was made available in the International Genebanks, and FAO is the custodian for that germplasm on behalf of the international community. Basically, when the CBD was signed there were two outstanding issues. The first was what will happen to the transactions of the materials which are there in the International Genebanks and the second was what will happen to the realization of farmers' rights. Only to answer those questions the International Undertaking on Plant Genetic Resources was transformed into the International Treaty. Now, it is this designated germplasm which is available in the International Genebanks *ex situ*. It was the transfer of that material which Dr. Bhatti was talking about this morning.

Q. – Mr. Riad Baazia (Consultant): What is the difference in the tools you used on rice, for example, as compared to those used, for example, by Monsanto? Or are you just focusing on some parts of the world and other international companies are focusing on other parts?

A. – M. Kock: The tools are essentially the same – the plant variety protection system and the patent system. The question is more how you use the tools. We normally file our patents just in the developed world, not in developing countries because, firstly, we do not have a business case there and, secondly, we do not see the benefits of patents in those countries in general. But what matters is how you use intellectual property rights in licensing, in collaboration.

Q. – Mr. Jonathan Woolley (Quakers United Nations Office): I really appreciated your presentation with a lot to think about and especially your emphasis on trying to understand were the differences among people are and how to resolve those. My question is more specific. In looking at IP as a tool you mentioned that it enables open innovation, that it encourages knowledge sharing. This morning we heard mention the Consultative Group on International Agricultural Research and its recognition as perhaps one of the most effective investments in development in terms of returns and then how Syngenta has participated in that work. When you made those statements about open innovation and knowledge sharing have you taken into account systems that work with a completely open approach to knowledge and sharing, so far? Or are these based more on philosophical principles? Because it seems to me there is evidence there in terms of what has worked in the past.

A. - M. Kock: It is based on the experience also with current models. What we have learned in some of these initiatives is: of course, you have a group of people, a group of stakeholders who are driving it. But you have also a larger group of people who benefit from it, who will never join such an initiative, the so called free riders. If you really want to move this kind of initiatives to something which has a true impact, which is pulling in also larger investment, I believe it requires preventing the free riders, those who benefit from the efforts without contributing. You can only cope with that challenge if you underpin that kind of investment with an IP system. It is more like a mechanism to enforce the proper behaviors. If everybody behaved the right way we would not need IP. If everybody in civil life behaved the right way we would not need laws. But we still need laws. So, it is about using IP to encourage beneficial behaviors of technology dissemination and benefit sharing.

Q. – Mr. François Meienberg (Bern Declaration): Some short questions. The first: you have spoken in favor of the research exemption. Does that mean that Syngenta would support changes of patent laws to introduce research exemptions, for example as we have it in the Swiss patent law? Would you favor the same in all other patent laws? The second question concerns the donations. You just said in an answer that you have been reluctant to open your collections or to put them into the Multilateral System of the Treaty because you do not like to have obligations. As you know, all legal entities, especially also seed companies, are invited to give their collections into the Multilateral System. Could you tell us if Syngenta will do this step or not and what would be the reason to do it or not to do it?

A. - M. Kock: We are in favor of a research exemption. The patent system should not stand in the way of innovation. The research exemption should be on the right level, however. In Switzerland it is on the right level, it is “research on … “ and not “research with … “ thereby allowing to improve an innovation without depriving the IP right holder of the value of his innovation. That is certainly something we strongly support. As far as your second question is concerned maybe you misunderstood me. I did not say that we did not want to have obligations. I said we do not want to put more obligations on third party users, such as the International Treaty system would imply. For instance, we did not want all the MTA obligations, all the follow ups, the reporting and the royalty payments. That is why we made the material available in a simpler way than under the International Treaty. Would we consider making the material available also under the Treaty? We need to be careful to have consistency in our approaches. We can certainly look into that. Currently our material is available even easier than it would be under the International Treaty.

Q. – F. Meienberg: There is a benefit sharing provision!

A. – M. Kock: The benefit sharing for the public domain means that the receiving party has an obligation not to protect it. Under the International Treaty you can still protect a product developed from material which you have received under the Multilateral System. If that product is not available for further research and breeding you owe a financial benefit sharing. The question is what the higher benefit is. We did not want to receive money; we rather preferred broader availability of the innovation and not being blocked ourselves with regard to future innovation. Thus, it is a trade-off, you can say, but something which is easier to administer than monitoring financial obligations.

Questions to Dr. Bruins

Q. – Mrs. Sangeeta Shashikant (Third World Network): I just have a question and a comment. In the presentation that you have made just now you mentioned about patent expiry and you said it is a new phenomenon and you are studying the consequences. Would you kindly elaborate on what are some of the concerns with patent expiry, because a patent usually lasts for at least 20 years? In that period even pharmaceutical companies that claim to spend about 800 million US Dollars in developing a product should have recouped their cost. It would just be interesting to note what some of the consequences are that you might be concerned about. The comment that I have is: Following from the earlier presentation and then your presentation, it sounds that we are giving out a little bit of a contradictory message. On the one hand, companies want access to the seeds that had been developed over decades, that are in national seed banks, that are in the CGIAR system, without having to take any obligations, particularly any benefit sharing obligations. So, they like to be so called free riders to access these seeds that have been developed over decades. On the other hand, this presentation and the previous presentation advocate for strong IP monopolistic types of systems on the basis that you need to recoup your cost, you need to recoup your investment. So, to me it sounds like a message that largely favors perhaps the interests of a few multinational companies but not necessarily the broader agricultural systems of developing countries.

A. – M. Bruins (ISF): Thank you very much, firstly, about the concerns on patent expiry. They are not related to recouping investment at all. They are entirely about the regulatory issues of biotech patents. I am solely referring to biotech patents. If other companies start to work, start to breed with those biotech varieties they need to implement systems in their companies to make sure that they apply the same rigor with regard to those regulatory issues. It has nothing to do with recouping investments; it is entirely about regulatory issues. Then, contradictory messages: companies who are investing their money in breeding varieties can certainly not be classified as free riders. What I would consider free riders are companies who take a variety from someone else, from somewhere, and then, without almost no breeding activity, would launch that variety and make a huge profit out of it. So, there is probably a misunderstanding about the concept of free rider.

A. – M. Kock: I think there is a difference in accessing material for propagation and accessing material for breeding and development. If we talk about the plant variety protection system, of course, these protected varieties are available for further breeding and development for everybody under even less conditions than the materials are available under the International Treaty. No commercial player is accessing material under the International Treaty for direct propagation but just for breeding and development. So, I do not see the problem you are referring to. I believe there are no more restrictions under the IP laws than there are under the International Treaty, to the contrary.

Q. – Dr. Shadrack R. Moephuli (ACR): My question concerns your (Dr. Bruins') remark about the yields of wheat, where you were saying that they were relatively stagnant with, may be, an indication that they are declining. You are offering a reason because of the farm saved seed. But how do you explain that in the context of an environment where you have a lot of large scale commercial farmers? By the very nature of their business those would not be interested in farm saved seed because yield is a very important aspect for their profitability. Could climate change be another factor that is coming through here?

A. – M. Bruins: Two factors: farm saved seed depending on the type of crops and the IP environment are probably the two most important reasons for insufficient research on wheat. There are probably other factors to explain the wheat/maize difference. But we are seeing that development and it is confirmed in other countries as well, the same divide between wheat and maize. Obviously, one of the differences is that wheat is very prone to copying. It is very easy to reproduce the same variety. Obviously, ISF does not want to block farm saved seed, absolutely not. But it is one of the factors that are hindering return on investment. If you wish to stimulate innovation there needs to be a way of capturing part of the return.

Q. – Mr. Riad Baazia (Consultant): The question that comes to my mind is whether intellectual property has a role to play in agricultural productivity and how can we insure food security. The impact of the IP system depends on how we use it, and the use we make depends on the context. But it is true: IP does have a role to play to provide for food security. I can tell you a very recent fact about scientists who are trying to find a way of cultivating rice in salty water, sea water, which is an option to help us to adapt to climate change. We have the field of e-agriculture and we also have the field of agricultural meteorology. We also have this thanks to the private sector. If we look at e-agriculture and the mobile phone networks, we have those thanks to the private sector and its developments of networks. Even in the most remote villages people are connected to a mobile phone network. It is important to use these tools which can be brought in under the umbrella of IP systems including brands. It means that we have available at our hands statistics on, for example, the climate and the weather. There is a difference between climate and weather but we tend to focus on the climate change, for example if we look at the UNFCCC that is really the organization that is always in the headlines particularly with the recent failing of the Kyoto Protocol. To conclude, I think meteorological observatories do have a very significant role to play, which is often overlooked, in order to provide information that would be very useful for farmers. Perhaps great use of this will be made in the future, and this is achieved via protecting developments under the intellectual property systems. If I could also indicate that ITO and WMO have programs in this respect and they are making progress bits by bits. But if I can come back to an issue that was raised before the LDC full conference in Istanbul which called for preferential and differentiated intellectual property treatment for LDCs and for developing countries, particularly in the global south. This was a call that was picked up by the World Bank and it is included in the May 2011 Istanbul Declaration.

The Importance of Public-Private Partnerships: Findings of an International Union for the Protection of New Varieties of Plants (UPOV) Seminar in April 2011 – Transcription of Oral Presentation by **Mr. Peter Button, Vice Secretary-General, UPOV**

Before summarizing the findings of the recent UPOV seminar “Plant Variety Protection and Technology Transfer: the Benefits of Public-Private Partnership”, I would like to provide a framework concerning the International Union for the Protection of New Varieties of Plants (UPOV), plant variety protection and plant breeding.

(Slides 1-5)

UPOV was established in 1961 by the International Convention for the Protection of New Varieties of Plants. The UPOV headquarters is located in Geneva, in the building of the World Intellectual Property Organization (WIPO). While being an independent Organization, UPOV has an agreement with WIPO whereby the Director General of WIPO is also the Secretary-General of UPOV. As of June 14, 2011, UPOV had 69 members; 68 states and one international intergovernmental organization, the European Union. The map in slide 5 shows the territories covered by UPOV, colored in green, and the States and Organizations which have initiated the procedure to become a member of UPOV, colored in brown.

(Slides 6 & 7)

The mission of UPOV is: “To provide and promote an effective system of plant variety protection with the aim of encouraging the development of new varieties of plants for the benefit of society”. New varieties are a crucial means of delivering new technologies to farmers and growers and, ultimately of course, delivering benefits through to consumers. However, these new varieties will not exist without the work of breeders, as several speakers have already explained. So, there is a need for a system that can support a thriving plant breeding sector.

(Slides 8 - 12)

There are many ways in which plant breeders and new varieties contribute to the benefits of farmers. We have seen, for example, the evolution of yields in wheat (France) and maize (United States of America) since the advent of modern plant breeding, at least 50% of which has been attributed to new varieties (slide 9). It is also important to look at the broader benefits of new varieties. With regard to climate change, there are already impressive examples to indicate how breeding is able to respond to differing environments. The maize crop, for example, up until 1970 was not adapted to cultivation in the Netherlands. It was only by the efforts of breeders that farmers are able to have new maize varieties that grow well in the Netherlands, having been adapted to their specific climatic conditions. These effects of breeding are quite broad in their scope and it is also important to be aware of the diversity of breeding objectives. Many people will be aware of breeding objectives such as improved yield, disease and pest resistance etc.. However, there are many other advantages that new varieties can bring. Slide 10 demonstrates the range of variation in the competition ability of different varieties of winter wheat with Blackgrass, which is of particular importance for weed control. This is just an example to illustrate the wide scope of traits that varieties can confer, some of which may not be obvious. The importance and scale of the contribution of plant breeding can be illustrated by the example of Rapeseed. Originally, only the oil component of rapeseed provided a useful product, as a lubricant for steam engines. It was only when breeders started to work on the crop that it attained major importance for agriculture. Firstly, breeders reduced the glucosinolate content so that the meal could be used for feeding animals. As a next step, breeding was employed to reduce the erucic acid content so that rapeseed could be used as a source of edible oil for human consumption. More recently, efforts are continuing, and breeders are working to develop high oleic and low linoleic acid varieties with nutritional benefits for consumers. In this one crop alone the dramatic developments that breeding is able to produce are exemplified, even without reference to the yield and agronomic improvements that have been developed in parallel. The result in this case is a substantial increase in the production of rapeseed and, thereby, diversification of cropping systems. Thus, plant breeding provides benefits to farmers but also delivers benefits to consumers and society as a whole. We can see those benefits in terms of reduced food cost, efficient land use, nutritional quality, diversity of products etc.. In short, breeders are delivering benefits and adding value through the agricultural chain of production.

(Slides 15 – 24)

Plant breeding is a long and expensive process. However, at the end of that process, new plant varieties can be very easily and quickly reproduced. Therefore, a system of protection is needed in order to allow breeders to recover their investment. One of the important aspects of the UPOV Report on the Impact of Plant Variety Protection (Impact Study) (see www.upov.int) was to look at how plant variety protection encourages breeders and breeding. The Impact Study illustrated the impact on the increasing diversity of breeders, particularly in the private sector, but also with regard to the public sector, where researchers were encouraged to focus their research towards more adapted varieties. In general, the Impact Study observed an overall increase in breeding activity as a result of the introduction of the UPOV system of plant variety protection. Slides 18 to 24 show that the UPOV system is not just geared towards encouraging development of breeding in the private sector. There is information that government breeding is incentivized, with additional income being made available through plant variety protection: there is growth not just in the private sector but also in the public sector breeding.

Slide 22 provides information on the developments in Argentina with regard to providing an effective system of plant variety protection and UPOV membership. In 1991, the National Institute of Seeds (*Instituto Nacional de Semillas*) (INASE) institute was created and the PVP system was amended to be in conformity with the 1978 Act of the UPOV Convention, except for certain aspects concerning foreign applications. Slide 22 demonstrates that those developments were accompanied by a substantial increase in the number of titles granted to domestic breeders. In 1994, the PVP system in Argentina became fully compatible with the 1978 Act of the UPOV Convention and Argentina acceded to the UPOV Convention. The number of titles granted to non-residents increased in conjunction with those developments.

The export of cut flowers provides the Kenyan economy with an important source of foreign exchange earnings, and a source of income for the development of the rural economy. Slide 23 provides information on the export of ornamental plants from Kenya, which increased rapidly between 1987 and 2008. That increase coincided with the increased number of applications for protection of varieties in Kenya, most of which concerned varieties of foreign origin. The introduction of foreign varieties contributed to the increased competitiveness of the Kenyan flower industry in the European market. After the introduction of PVP in Kenya in 1997, the volume of exports increased from approximately 40,000 tons to 120,000 tons – a three-fold increase. However, the value of those exports increased eight-fold, from approximately 5 billion Kenyan Shillings to 40 billion Kenyan Shillings. Thus, having the right variety is important for success in the market place.

The analysis in Japan (Slide 24) demonstrates the diversity in types of breeders that develop new varieties where the UPOV system of plant variety protection is in place. This indicates the relevance of PVP for different types of breeders in the private sector, the public sector and also for public-private partnerships.

(Slides 25 and 26)

It may be useful to recall some of the key aspects of the UPOV Convention to explain how this is applicable to different types of breeders, particularly with regard to the breeder’s right and exceptions. The breeder’s right in the 1991 Act of the UPOV Convention (see www.upov.int) sets out the rights which a breeder has on propagating material of a protected variety. It is the choice of the breeder to decide who is authorized to grow the variety and on what terms. This is an important aspect to be considered by public sector or private sector breeders.

(Slide 27)

It is also relevant to recall that there are exceptions to the breeder’s right in the UPOV Convention. Certain exceptions are compulsory, and there is also an optional exception.

(Slides 28 and 29)

The first exception I would like to present is the compulsory exception for acts done privately and for non-commercial purposes. Acts done privately and for non-commercial purposes fall outside the scope of the breeder's right. Thus, where "subsistence farming" means the propagation of a variety by a farmer exclusively for the production of a food crop to be consumed entirely by that farmer and the dependents of the farmer living on that holding, such farming may be considered by a UPOV member to be excluded from the scope of the breeder's right.

(Slides 30 and 31)

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

(Slides 32 and 33)

Finally, with regard to the exceptions, I would like to refer to the breeders' exemption, which is a compulsory exception. The exception under Article 15(1)(iii) of the 1991 Act states that the breeder's right shall not extend to "acts done for the purpose of breeding other varieties, and, except where the provisions of Article 14(5) apply, acts referred to in Article 14(1) to (4) in respect of such other varieties.". This is a fundamental element of the UPOV system of plant variety protection known as the "breeder's exemption", whereby there are no restrictions on the use of protected varieties for the purpose of breeding new plant varieties. The second part of Article 15(1)(iii) "and, except where the provisions of Article 14(5) apply, acts referred to in Article 14(1) to (4) in respect of such other varieties." clarifies that, except for the varieties included in Article 14(5), i.e., essentially derived varieties; varieties which are not clearly distinguishable of the protected variety and varieties whose production requires the repeated use of the protected variety, the commercialization of the new varieties obtained does not require the authorization of the title holder of the protected variety used to create those new varieties.

(Slides 34-36)

The summary chart in Slide 34 shows new varieties as a means of transferring technology down the chain of production. In addition, the breeder's exemption is also a very good mechanism for providing technology transfer back up the chain, by allowing new varieties to be used by other breeders.

With regard to technology transfer to farmers, growers and consumers, it is important to realize that, in the context of agriculture, varieties and seed, it is not quite as simple as just producing new varieties, feeding them into the chain and assuming that they will arrive with farmers and consumers. Many players need to be engaged in that process. The findings of the recent UPOV seminar "Plant Variety Protection and Technology Transfer: the Benefits of Public-Private Partnership" (UPOV Seminar) (see www.upov.int) highlighted a number of aspects in that regard.

(Slide 37)

In the first session, presentations were made by national research centers on their use of plant variety protection. One of the key conclusions was that plant variety protection is a tool for technology transfer, which promotes private sector involvement in research and development. In other words, it promotes private sector involvement in the early stages of variety development and helps to ensure that research and variety development is focused on the needs of farmers and consumers. An important basis for that result is the legal framework for financial investment provided by plant variety protection.

(Slides 38-39)

Slides 38 and 39 contain data provided by Mr. Felipe de Moraes Teixeira, Brazilian Agricultural Research Corporation (EMBRAPA), Brazil, illustrating the value that plant variety protection offers in its research. Every US Dollar invested in EMBRAPA research generates an average return of six and a half US Dollars for Brazilian society.

(Slide 40)

An important session of the UPOV Seminar concerned the role of the private sector in its relationships with the public sector. A clear conclusion was that the private sector provides an effective means of delivering varieties to farmers. In that regard, the private sector can be a very important partner for public sector breeders in delivering seed to farmers. In addition, the private sector also provides feedback from farmers to breeders. It was concluded that the private sector provides a key role in assessing the market potential of varieties and making the connection from the farmers to the public sector researchers. The plant variety protection system was identified as an important means of facilitating strategic associations and coordinated technology transfer in the context of public-private partnerships.

Slide 43 provides a summary of information presented at the Seminar by Mr. Wicki, DSP SA (Switzerland), who identified three stages in wheat variety development and delivery of seed to farmers: firstly, development of new varieties, (breeding); secondly, variety evaluation; and, thirdly, seed production and supply to farmers. In Switzerland, under the DSP arrangement with Agroscope, the public sector is involved in developing new varieties and to some extent in final evaluation of those varieties. However, it relies on the commercial, private company – DSP – to help to evaluate varieties and to deliver high quality seed to farmers. Slide 44 illustrates a similar situation with regard to grass development in New Zealand, presented by Ms. Jenn James Grasslanz Technology, again identifying the different stages from variety (cultivar) concept through plant breeding, evaluation, market delivery and value created. From the beginning of the process, there is involvement of the public and private partners. Plant breeding, in this case, was undertaken by the public sector AgResearch; the varieties were then transferred to Grasslanz Technology and to seed companies to bulk up those varieties and to deliver high quality seed to farmers.

(Slide 45)

In the UPOV Seminar, there were several presentations from national public research centers about why plant variety protection is important for them and how they use the private sector to support their activities. The third session of the UPOV Seminar provided a view of the international research centers on intellectual property protection. Mr. Lloyd Le Page, Chief Executive Officer, Consultative Group on International Agricultural Research (CGIAR) Consortium, explained that variety protection provided a mechanism to facilitate dissemination of varieties to farmers and noted that open access does not ensure widespread dissemination or use. One of the conclusions from the session was that plant variety protection often provided an incentive for small and medium sized local enterprises to become seed distributers and, thereby, to benefit from intellectual property rights. It was also recalled that the breeder’s exemption provided a mechanism to facilitate access to germplasm for further breeding. Finally, it was noted that the use of plant variety protection was consistent with the International Treaty on Plant Genetic Resources for Food and Agriculture and its Standard Material Transfer Agreement (SMTA).

(Slide 46)

In summary, the conclusions of the Seminar demonstrated the value of plant variety protection for encouraging the development of new varieties of plants that respond to the needs of farmers, growers and consumers and for encouraging investment in the delivery of those varieties to farmers and growers. It was seen that the UPOV system of plant variety protection played an important role for the private sector, public sector and for public-private partnerships.

Seminar on How the Private and Public Sectors Use Intellectual Property to Enhance Agricultural Productivity

The Importance of Public-Private Partnerships:

Findings of the International Union for the Protection of New Varieties of Plants (UPOV) Seminar in April 2011

Peter Button (Vice Secretary-General, UPOV)

Geneva, June 14, 2011

1

PREVIEW

- **Overview of UPOV**
- **Importance of Plant Breeding, Plant Variety Protection and UPOV**
- **Findings of the UPOV Seminar**

UPOV SEMINAR ON
PLANT VARIETY PROTECTION AND
TECHNOLOGY TRANSFER:
THE BENEFITS OF PUBLIC-PRIVATE
PARTNERSHIP
Geneva, April 11 and 12, 2011

2

UPOV: INDEPENDENT INTERGOVERNMENTAL ORGANIZATION

The International Convention for the Protection of New Varieties of Plants

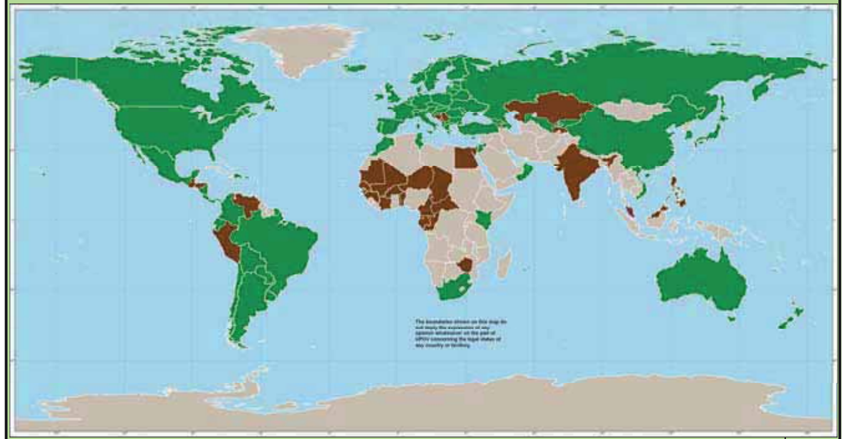
established in 1961

The International Union for the Protection of New Varieties of Plants

Union internationale pour la protection des obtentions végétales

3

Members of UPOV (green) & initiating States & organizations (brown)



5

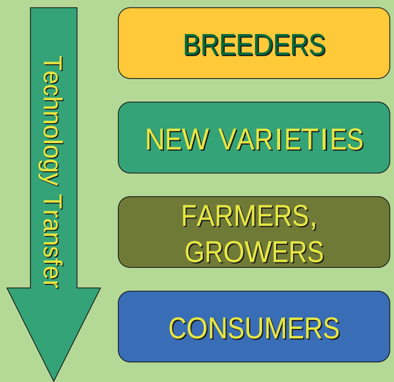
UPOV

UPOV MISSION STATEMENT

"To provide and promote an effective system of plant variety protection, with the aim of encouraging the development of new varieties of plants, for the benefit of society"

6

Importance of Plant Breeding



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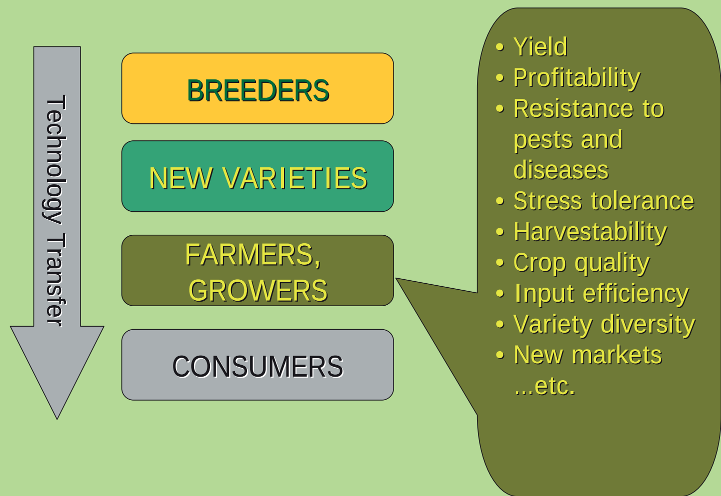
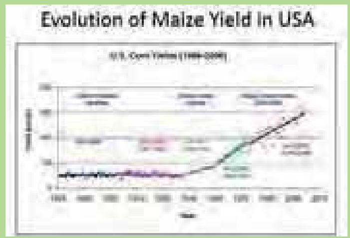
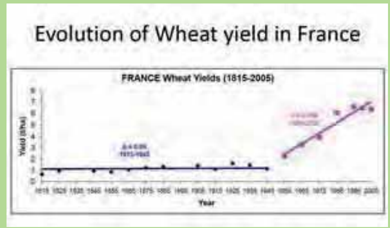
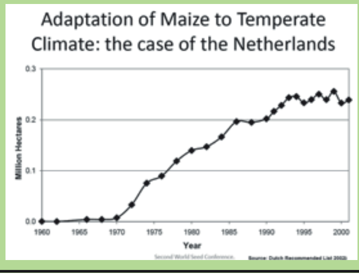
Importance of Plant Breeding



Importance of Plant Breeding







Bernard Le Buanec,
Second World Seed Conference (Rome, September 2009)

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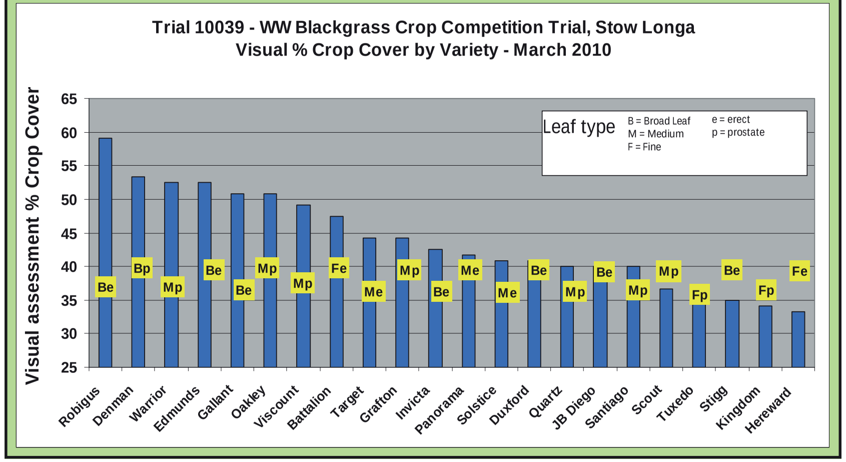
UPOV SEMINAR ON PLANT VARIETY PROTECTION AND TECHNOLOGY TRANSFER: THE BENEFITS OF PUBLIC-PRIVATE PARTNERSHIP
Geneva, April 11 and 12, 2011

Barry Barker
Masstock Arable UK Ltd



SEMINAR ON PLANT VARIETY PROTECTION AND TECHNOLOGY TRANSFER: THE BENEFITS OF PUBLIC-PRIVATE PARTNERSHIP

Yves Lespinasse

INRA

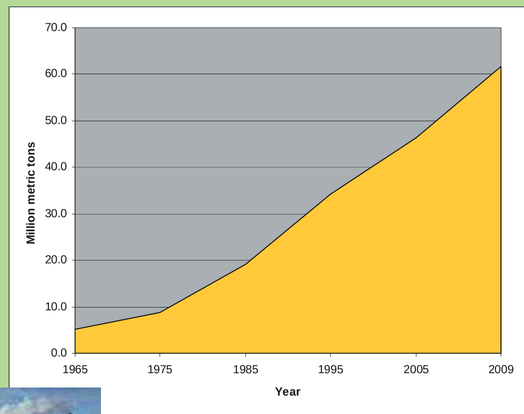
Glucosinolate content

from 100 µmoles ('Jetneuf') to 12 µmoles ('Samouraï')

LEAR: Low Erucic Acid

HOLLI: High Oleic and Low Linolenic

World Total Rapeseed Production



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Importance of Plant Breeding

Technology Transfer

BREEDERS

NEW VARIETIES

FARMERS, GROWERS

CONSUMERS

- Reduced food cost
- Efficient land use
- Nutritional quality, taste etc.
- Storage quality
- Diversity of products

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Importance of Plant Breeding

ADDED VALUE

BREEDERS

NEW VARIETIES

FARMERS, GROWERS

CONSUMERS

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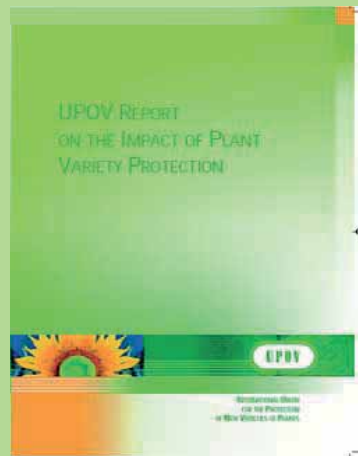
- **Plant breeding is long and expensive**

BUT

- **Plant varieties can be easily and quickly reproduced**

➔Breeders need protection to recover investment

15



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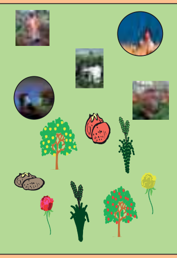
FINDINGS

Introduction of UPOV system

Diverse types of breeders (private breeders, researchers)

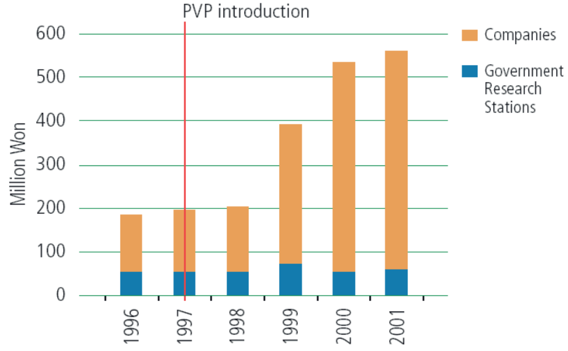


Increases breeding activities

17

Importance of Plant Variety Protection and UPOV

Figure 55. Republic of Korea: Breeding Investment-Chinese Cabbage



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Importance of Plant Variety Protection and UPOV

Figure 29. China: Number of Breeders in Henan Province **(Maize)**

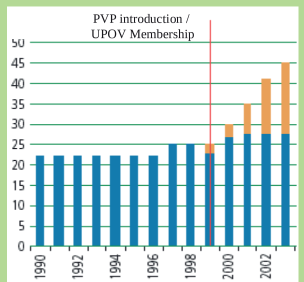
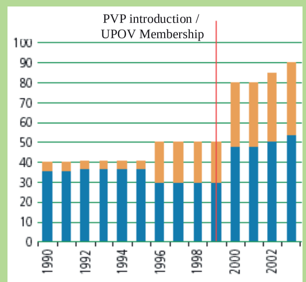


Figure 30. China: Number of Breeders in Henan Province **(Wheat)**

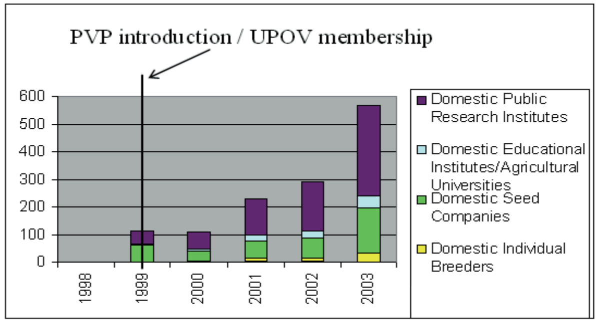


Number of other breeders
Number of breeders at the Provincial Research Institute

19

Importance of Plant Variety Protection and UPOV

Figure 33. China: Number of Applications by Categories of Applications (Agriculture)



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Importance of Plant Variety Protection and UPOV

Figure 52. Republic of Korea: Number of Rose Breeders

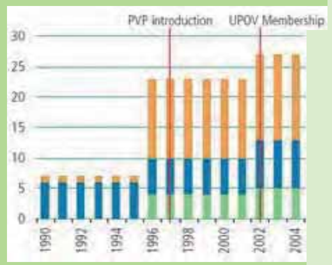
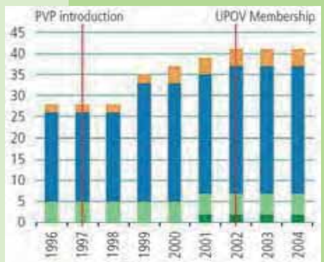
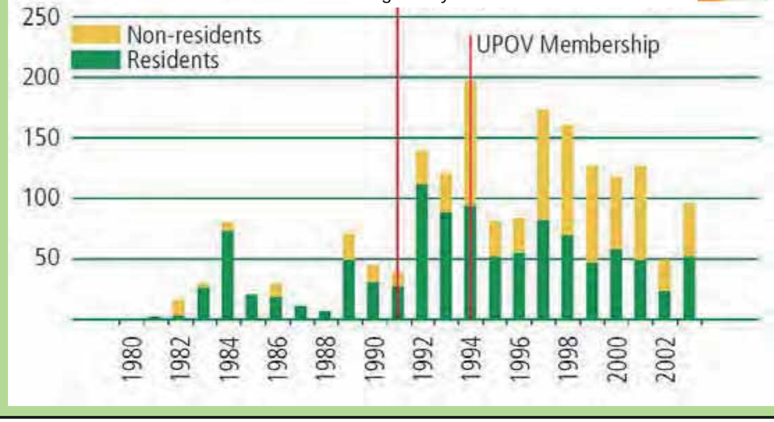


Figure 53. Republic of Korea: Number of Rice Breeders



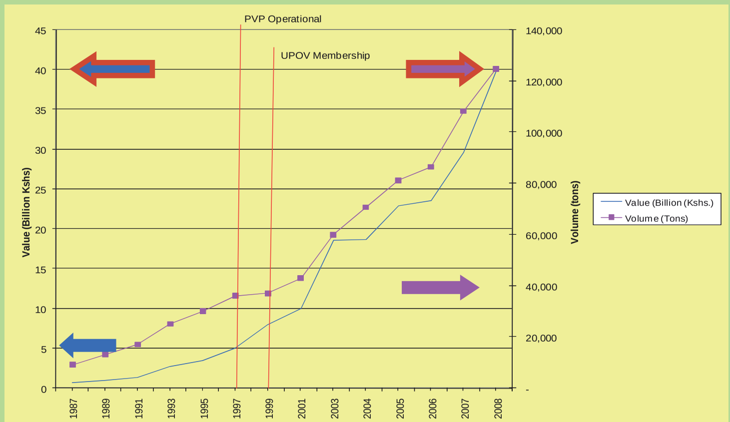
Importance of Plant Variety Protection and UPOV

Figure 13. Argentina: Number of Titles Granted



Importance of Plant Variety Protection and UPOV

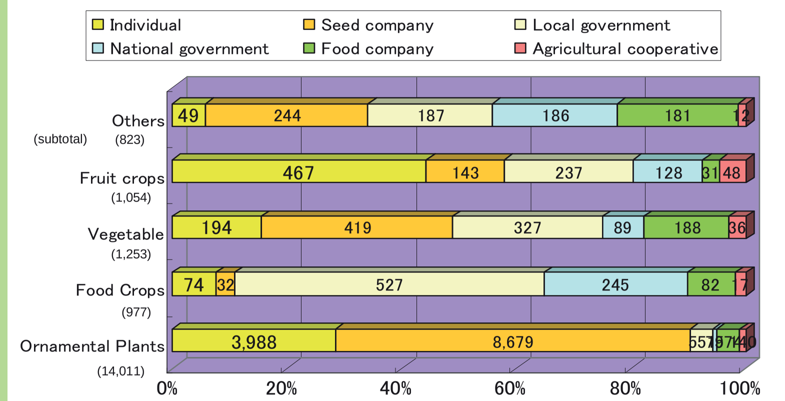
Export of Kenyan Cut Flowers



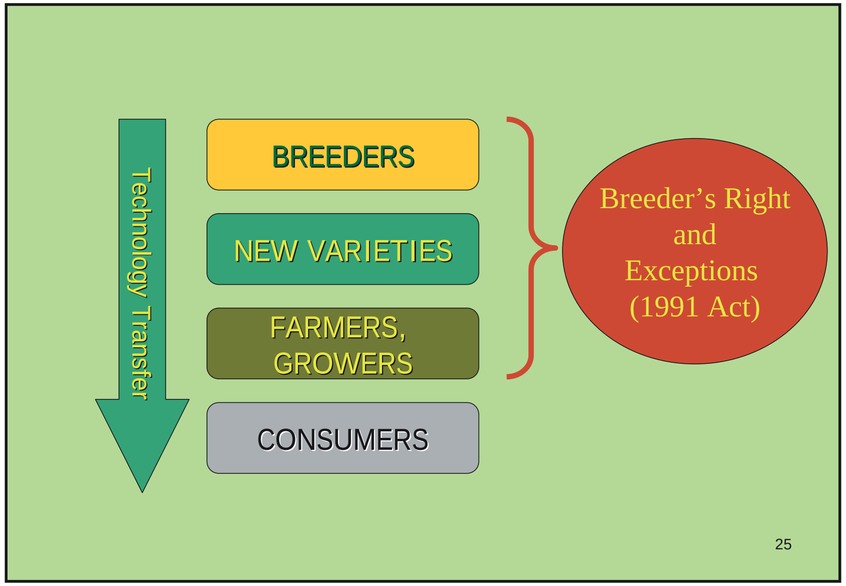
Evans Sikinyi, Second World Seed Conference

Importance of Plant Variety Protection and UPOV

Registration Number by Breeder (Japan) (～March 31,2009)



Yasunori Ebihara, International Symposium (Seoul, August 2009)



Breeder's Right

[1991 Act of UPOV Convention]
Article 14
Scope of the Breeder's Right

(1) [*Acts in respect of the propagating material*]

(a) Subject to Articles 15 and 16, the following acts in respect of the propagating material of the protected variety shall require the authorization of the breeder:

(i) production or reproduction (multiplication),
(ii) conditioning for the purpose of propagation,
(iii) offering for sale,
(iv) selling or other marketing,
(v) exporting,
(vi) importing,
(vii) stocking for any of the purposes mentioned in (i) to (vi), above.

(b) The breeder may make his authorization subject to conditions and limitations.

BREEDERS decide their policy on authorization, including conditions/limitations

Exceptions to the Breeder's Right

Compulsory

Acts done:

- privately and for non-commercial purposes
- for experimental purposes
- breeding other varieties (breeder's exemption)

Optional

Farm-saved seed

27

Exceptions to the Breeder's Right

Compulsory

Acts done:

- **privately and for non-commercial purposes**
- for experimental purposes
- breeding other varieties (breeder's exemption)

Optional

Farm-saved seed

28

Exceptions to the Breeder's Right

- Compulsory
  - (i) Acts done privately and for non-commercial purposes

- propagation of a variety by a **farmer exclusively** for the production of a **food crop to be consumed entirely by that farmer and the dependents of the farmer** living on that holding

therefore

"subsistence farming" where these constitute acts done privately and for non-commercial purposes, may be considered by a UPOV member to be excluded from the scope of the breeder's right

Acts Possibly falling within the scope of the exception

29

Exceptions to the Breeder's Right

Compulsory

Acts done:

- privately and for non-commercial purposes
- for experimental purposes
- breeding other varieties (breeder's exemption)

Optional

Farm-saved seed

30

Exceptions to the Breeder's Right

A Contracting Party may restrict breeder's rights in order to **permit farmers to use for propagating purposes on their own holdings the product of the harvest obtained on their own holdings** from the protected variety **within reasonable limits subject to safeguarding legitimate interests of the breeder**

[Article 15(2) and Recommendation of the Diplomatic Conference]

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Exceptions to the Breeder's Right

Compulsory

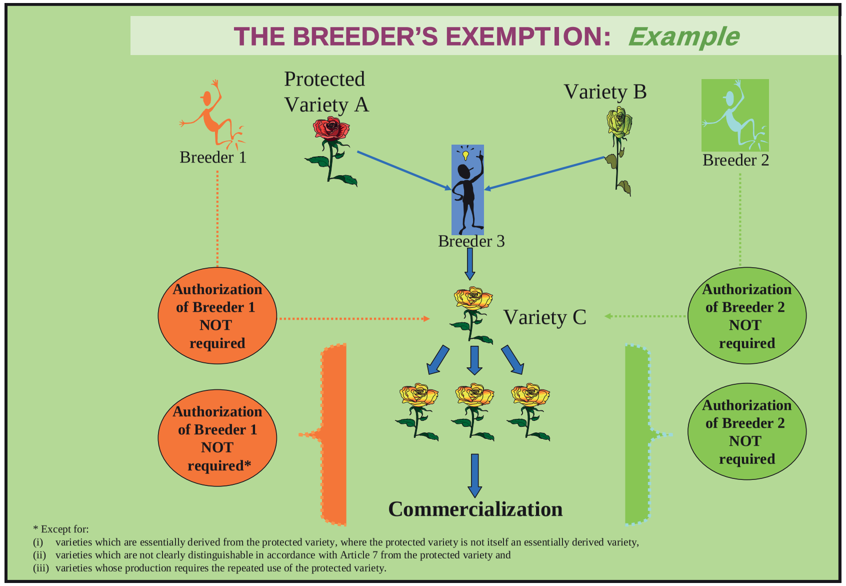
Acts done:

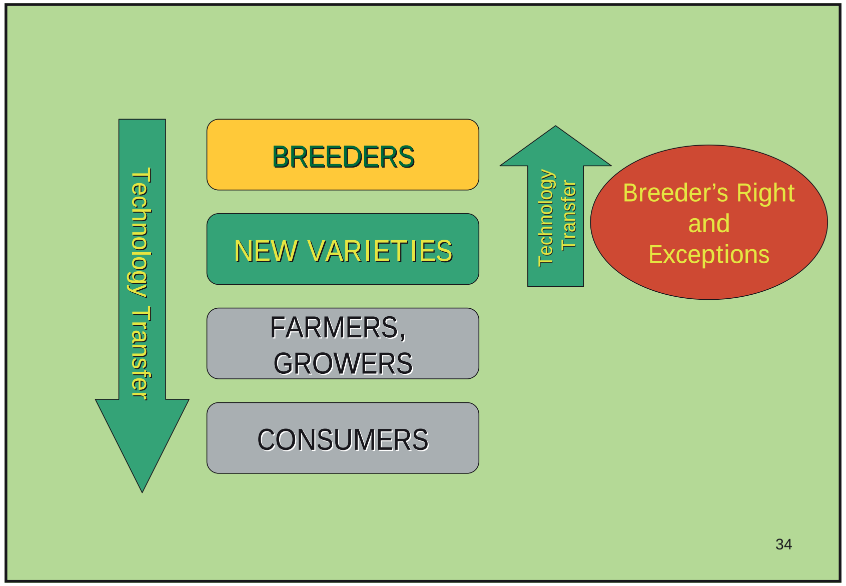
- privately and for non-commercial purposes
- for experimental purposes
- **breeding other varieties (breeder's exemption)**

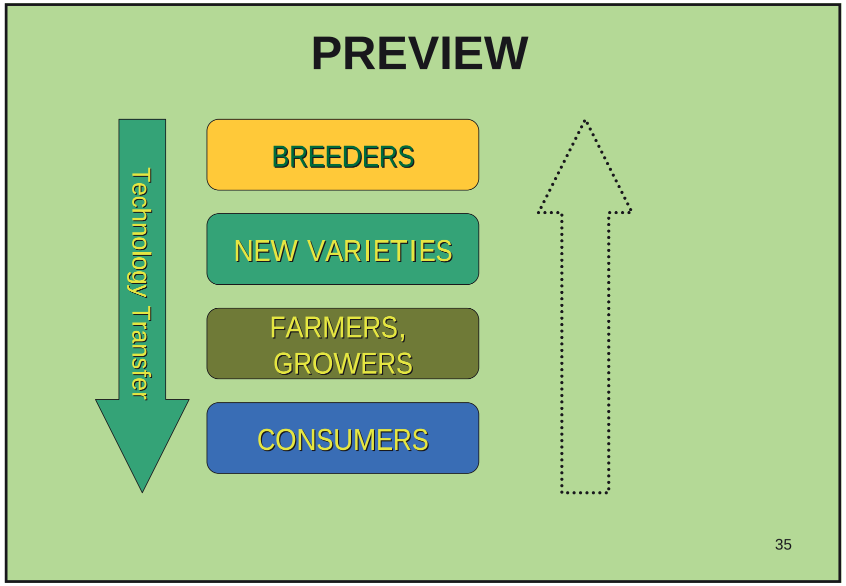
Optional

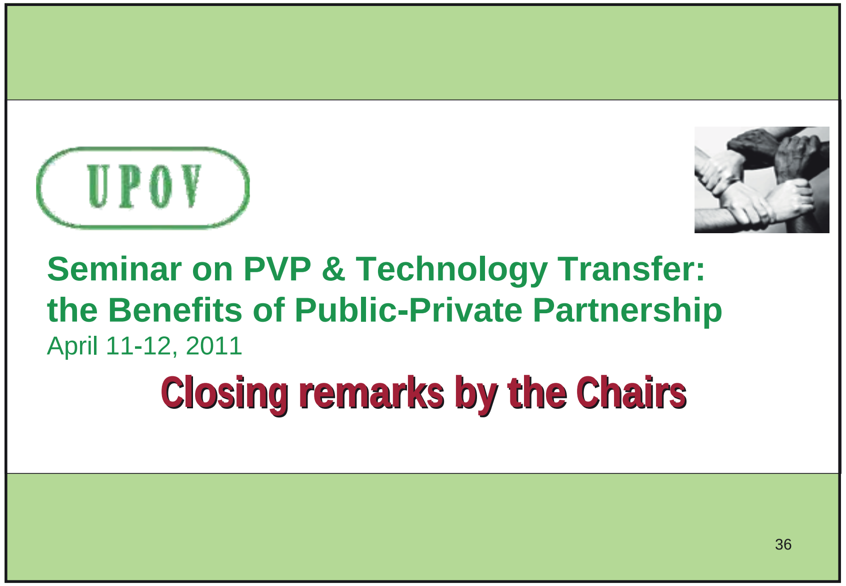
Farm-saved seed

32


THE BREEDER'S EXEMPTION: *Example*
Protected Variety A
Variety B
Breeder 1
Breeder 2
Breeder 3
Variety C
Authorization of Breeder 1 NOT required
Authorization of Breeder 2 NOT required
Authorization of Breeder 1 NOT required*
Authorization of Breeder 2 NOT required
Commercialization
* Except for:
(i) varieties which are essentially derived from the protected variety, where the protected variety is not itself an essentially derived variety,
(ii) varieties which are not clearly distinguishable in accordance with Article 7 from the protected variety and
(iii) varieties whose production requires the repeated use of the protected variety.


Technology Transfer
BREEDERS
NEW VARIETIES
FARMERS, GROWERS
CONSUMERS
Technology Transfer
Breeder's Right and Exceptions
34


PREVIEW
Technology Transfer
BREEDERS
NEW VARIETIES
FARMERS, GROWERS
CONSUMERS
35


UPOV
Seminar on PVP & Technology Transfer:
the Benefits of Public-Private Partnership
April 11-12, 2011
Closing remarks by the Chairs
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Use of Plant Variety Protection by National Research Centers

Chair: Enriqueta Molina Conclusions – Session 1

Plant Variety Protection:

- Promotes private sector involvement in research and development
- A tool for technology transfer
- Provides a legal framework for financial investment
- Encourages innovation in breeding aims, particularly for the development of new or niche markets
- Focuses investment on meeting the needs of farmers and consumers

Chair: Enriqueta Molina

1. Ryudai Oshima, NARO
2. Jenn James, Grasslanz
3. Shadrack R. Moephuli, ARC
4. Filipe de Moraes Teixeira, EMBRAPA
5. Yves Lespinasse, INRA

UPOV SEMINAR ON PLANT VARIETY PROTECTION AND TECHNOLOGY TRANSFER: THE BENEFITS OF PUBLIC-PRIVATE PARTNERSHIP Geneva, April 11 and 12, 2011

Filipe Geraldo de Moraes Teixeira
Head, Technology Innovation Office, Embrapa, Brazil

Embrapa Ministry of Agriculture, Livestock and Food Supply BRAZILIAN GOVERNMENT BRASIL

PVP: Returns on Research Investment

Every US$ 1.00 invested at Embrapa generates an average return of US$ R$ 6.40 for Brazilian society

Embrapa generates a social surplus of US$ 11.62 Billion

85,725 jobs generated by Embrapa Technologies

710 relevant social initiatives

Brazilian agribusiness handles about 750 billion dollars per year

Agriculture represents 28% of Brazilian GDP

Agribusiness in Brazil generates more than 17 million jobs (37% of Brazilian workforce)

In the agriculture sector Brazil is the 3rd largest exporter country in the world

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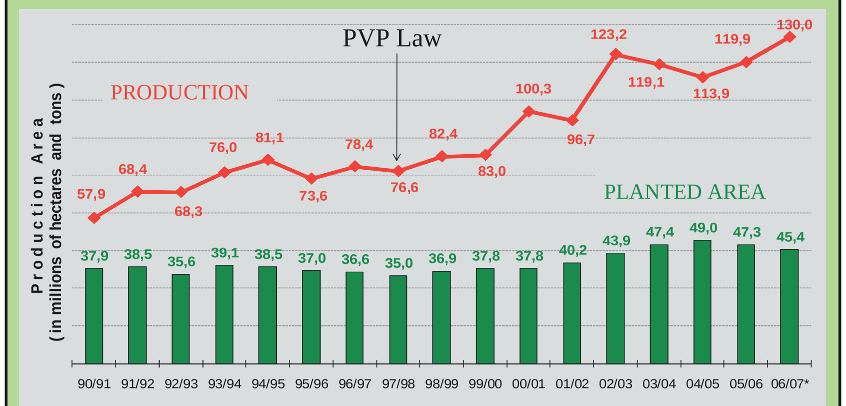
UPOV SEMINAR ON PLANT VARIETY PROTECTION AND TECHNOLOGY TRANSFER: THE BENEFITS OF PUBLIC-PRIVATE PARTNERSHIP Geneva, April 11 and 12, 2011

Filipe Geraldo de Moraes Teixeira
Head, Technology Innovation Office, Embrapa, Brazil

Embrapa Ministry of Agriculture, Livestock and Food Supply BRAZILIAN GOVERNMENT BRASIL



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Technology Transfer by the Private Sector

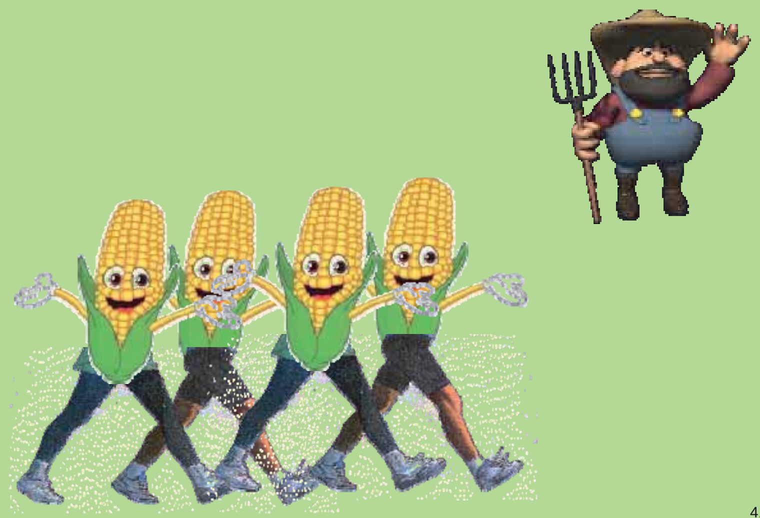
Chair: Kitisri Sukhapinda Conclusions – Session 2

Private sector:

- An effective means of delivering varieties to farmers

Chair: Kitisri Sukhapinda

1. Willi Wicki , DSP
2. Barry Barker, Masstock Arable
3. Diego Risso, URUPOV
4. Evans Sikinyi, KY



Technology Transfer by the Private Sector

Chair: Kitisri Sukhapinda Conclusions – Session 2

Private sector:

- An effective means of delivering varieties to farmers
- Assessment of the market potential of varieties
- Link between public research and the needs of farmers
- Provides a channel for income for public sector research
- Facilitates strategic associations and coordinated technology transfer

Chair: Kitisri Sukhapinda

1. Willi Wicki , DSP
2. Barry Barker, Masstock Arable
3. Diego Risso, URUPOV
4. Evans Sikinyi, KY

UPOV SEMINAR ON PLANT VARIETY PROTECTION AND TECHNOLOGY TRANSFER: THE BENEFITS OF PUBLIC-PRIVATE PARTNERSHIP Geneva, April 11 and 12, 2011

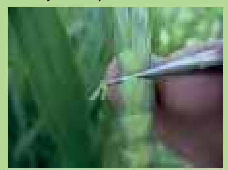
Wilhem Wicki

DSP

Task sharing and part of public and private funding of the Swiss wheat breeding program

Public funding (Agroscope)

Variety development



Final Evaluation

Final Evaluation

Maintenance breeding,
Basic seed production,
PVR protection,
Variety representation in Switzerland, in Europe and worldwide

Private funding (DSP Ltd), source: Royalty fees from protected varieties

UPOV SEMINAR ON PLANT VARIETY PROTECTION AND TECHNOLOGY TRANSFER: THE BENEFITS OF PUBLIC-PRIVATE PARTNERSHIP Geneva, April 11 and 12, 2011

Jenn James

grasslanz

Plant Variety Development

	Cultivar Concept and Collaboration	Plant Breeding and Evaluation	PVR and Nucleus Seed	Production and Processing	Market Delivery	Value Created
Project Stage	Opportunity identified	Product Created	Ownership secured	Inventory build-up	Farmer delivery	Product support
Primary Driver	Grasslanz Seed Company AgResearch	AgResearch	Grasslanz	Seed Company	Seed Company	Grasslanz Seed Company AgResearch

Project Contributions

AgResearch: **Plant Breeding and innovation, education**

Grasslanz: **Plant Variety Protection, nucleus seed, finance, project coordination, stewardship.**

Seed Company: **Seed production and processing, marketing, finance, royalties, knowledge transfer.**

International Research Centers

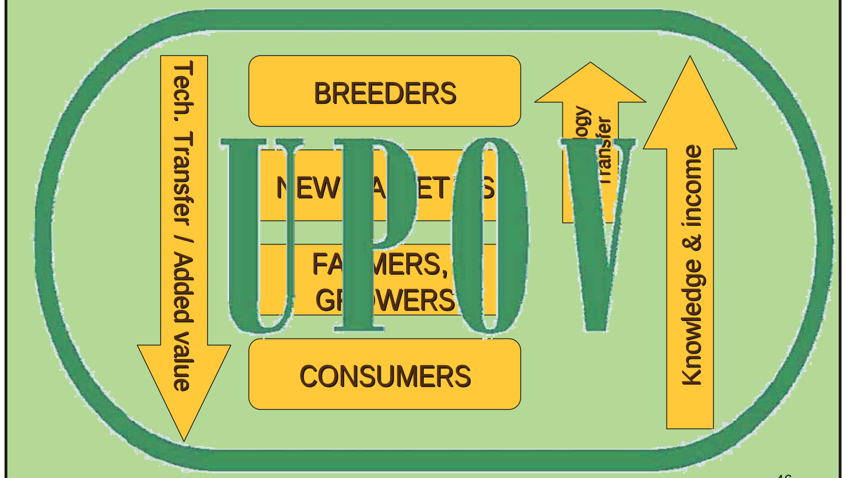
Chair: David Boreham Conclusions – Session 3

- PVP provides a mechanism to facilitate dissemination of varieties to farmer open access does not ensure widespread dissemination or use
- PVP provides a system to increase availability of varieties suited to farmers' needs
- PVP provides incentives for SME's, particularly local breeders and seed distributors
- The breeders' exemption provides a mechanism to facilitate access to germplasm
- The use of PVP is consistent with the ITPGRFA and SMTA

Chair: David Boreham

1. Lloyd Le Page, CGIAR
2. Ruaraidh Sackville Hamilton, IRRI
3. Ian Barker, Syngenta

SUMMARY



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THANK YOU

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General discussion chaired by Dr. Johannes Christian Wichard, Deputy Director General of WIPO

Dr. Sudhir Kochhar (PIU/NAIP/ICAR): One of the increasing concerns that I had was about cooperation in the management of intellectual property in various forms, including plant variety protection. Article 27.3.(b) of the TRIPS Agreement allows protection in multiple forms. Some of the basic issues were brought to the fore as to the real management issues that can crop up at the micro level. One of the issues there is the priority date. If it is plant variety protection and if it is UPOV members then we are clear what the priority date is. If it is patent alone then also we know what the priority date is. But if there is an interested player in a particular jurisdiction and he has got a protection in one form, or, at least, filed an application in one form (say PBR); and, then he/she has to approach the other jurisdiction to get protection in another form (say Plant Patent or vice versa), then what will happen to the priority date? For example in India, for plant varieties there are no patents available and breeders have to go only for plant variety protection. There has to be some forum dealing with such issues. This was one issue which I have raised in India before “IP India”, i.e. the Controller General of patents, and trade marks which also takes care of geographical indications and designs; but plant variety protection and copy rights still fall under the responsibility of different offices. IP India responded that they have developed some relationship with the PVP Office. On the international level there should be some kind of formalized coordination between different offices. There are some other fundamental things to be addressed too. As I brought in with my last slide, the academic part of the IP has to be built-up.

Dr. Johannes Christian Wichard (WIPO): Thank you for that practical remark. This is perhaps something to be further explored also with UPOV. At WIPO we have voluntary digital access service for priority documents. But that applies only to patents and only to participating intellectual property offices.

Mrs. Karen Ferriter (Permanent Mission of the United States of America to the Word Trade Organization (WTO)): I just have a comment; it is to thank you. I think this has been an excellent program. It seems to me that the role of the public sector is to primarily provide access to the genetic materials that are used for plant breeding and to identify important areas of research that needs to be done. And that role is also strengthened by the private sector as it also provides its materials to the public, often protected by intellectual property rights but not necessarily. Often the private sector helps to further refine where the public research can be most productive. So, this is a very important program, I appreciate your holding it and I look forward to future developments.

Mrs. Carmen Thönnissen (Swiss Agency for Development Cooperation): We heard extensively today about IP and its importance for breeding. What about IP and all the other technologies, methodologies and good agricultural practices that are used next to using seeds? How relevant is IP in those fields? We have hardly heard anything about today.

J.C. Wichard: A very valid remark. It has come up, for example in the presentation of Mr. Kochhar. Also other speakers have referred to, for example, geographic indications, appellations of origin and trademarks as other forms of intellectual property rights that can be extremely useful in creating value around agricultural production. But, certainly, it deserves attention in our further activities.

Dr. Shadrack R. Moephuli (ARC): This is one of the matters we try to cope with when dealing with issues of development, particularly for subsistence farmers or small holder farmers: to what extent are you able to insure that you have got the technologies and the information that is not necessarily protected intellectual property, associated with an innovation under IP protection? Such technologies and information actually must accompany that innovation in order for it to be practical and functional to the user. There is no use simply transferring a technology with a license and nobody knows how to use it. Now, this is the challenge that many of us are facing in dealing with resource poor small holder farmers and sometimes subsistence farmers. It actually means you must put in place mechanisms that require you to provide support and training to enable those who are expected to use your technologies effectively and properly.

J.C. Wichard: Again a most relevant comment. Just a patent, a license does not give you all that much; you need to be able to put it into practice. Dr. Mbithi, in his presentation, has given us an impressive example of how small holder farmers have been integrated into the value chain by using the IP system.

Dr. Stephen Mbithi Mwikya (FPEAK): I wish to agree with the views expressed by the two colleagues. You need more than a patent, more than a license. A mechanism of ensuring that there is innovation is good. But a process that ensures that the benefits of that mechanism are seen by many is something that UPOV might want to explore. It is important to think beyond mechanism setting. More needs to be done with regard to education, information, facilitation. With regard to small holders we have accepted that the introduction of a technology like, for example, a superior variety, needs to go hand in hand with lots of promotion and lots of good agricultural practices to ensure that the expensive seed that farmers have bought, or which we just provided to them, brings real benefits to them and, therefore, encourages further use. We come up with lots of additional innovations with regard, for example, to good agricultural practices. We have been able to comply with some of the most stringent international standards, including public and also private sector standards, which ensure that good agricultural practices are routine among the farmers. Thus, the seed is only part of that big equation of capacity building. With regard to credit and availability of money to be able to afford the seed, we have been able to come up with mechanisms that ensure that the farmer does not need to have money at time zero, at the time of planting. If he has the fundamentals of production, like land and water, we are able to ensure that those slightly higher on the value chain, like the buyers of the produce, can advance seed for value which is recovered at the moment of harvest. With regard to safeguarding those small holders from situations of contract farming, that could be not in their interest, over the years there has been evolution whereby farmers acquired the knowledge and accumulated enough resources that allows them now to afford the seeds perpetually. So, huge activities are necessary to ensure that the message of superior seeds is adaptable at the lowest level of the farmer, is practical. Therefore, what matters is that the money for the purchase of the seed – part of that is going to the breeder who has invested knowledge – is realizable from the economic benefits achieved by that segment of the value chain, the small holder. It is not just about patents and licenses; it is a package of enhanced productivity and a functional system that awards everybody.

Mrs. Irene Kitsara (Patent Information Section, WIPO): Licensing agreements are often complemented by know how agreements. So, the transfer of technology is not just limited to the invention as such. In some cases a better negotiation of such licensing agreement with the inclusion of such additional know how transfer is essential because a patent as such given to non-experts so as to a farmer could not be of help as such. What I wanted to ask is more addressed to UPOV. From what I understood from public-private partnerships, they seem to play a role in establishing new plant varieties and in the development of plant varieties. But what I see from the discussion, a problem seems to be what happens afterwards, the dissemination of the knowledge on the new varieties. Because, in the UPOV database we have information related to the individual plant varieties but we do not have any information related to the properties of that variety. For instance, we heard before about resistance to biotic or abiotic stress. How can a breeder retrieve this information? I am not an expert – it seems that the private sector plays the role approaching the breeders in the various countries and offering various solutions. A collection of this information that already exists would, maybe, provide some solutions to the breeders, to the countries who have identified their problems but have not yet found a solution until they are approached by the private sector.

Mr. Peter Button (UPOV): I believe that you are familiar with the UPOV-ROM Plant Variety Database, which contains information such as the variety name, status of protection, inclusion of a variety in a national list of varieties etc.. However, certainly, that will not tell you how to grow the variety or whether it is a suitable variety. That information is available not through the UPOV-ROM but through, for example, the country where the variety is protected. Information on the performance of a variety is environmentally linked, such that it is not always informative to generalize about whether a variety performs well in a global sense; it is linked to a particular environment. A lot of that information is widely available and it is a major part of the work of the seed sector to inform farmers about variety performance for their conditions. However, it is targeted towards the intended farmers, not targeted globally. The information on variety performance is of great importance and PVP helps to ensure that there is investment in providing that knowledge to farmers. Of course, if you wished to do a global assessment, that information is often freely available. Finally, it is important to recall that, under the UPOV system of plant variety protection, an important aspect of the “know-how” is provided by in the variety itself, which is directly available for breeding under the breeders’ exemption.

J.C. Wichard: Before we conclude I would like to invite some general comments on the very practical proposals made by Dr. Kock to establish some cooperation in the form of either an open innovation platform or a technology transfer or licensing platform. You have made fairly specific proposals. Do you already have experiences with that or is this just something which you have provided to us as food for thought?

Dr. Michael Andreas Kock (Syngenta AG): Somewhere in between. We are having some discussions currently with some stakeholders on the CGIAR side whether that is an opportunity to set up such a cooperation, also with some initiatives via the Syngenta Foundation in Africa but it is not yet concrete. We have one example in Africa but it is in a country where you have no IP regime; so, in that case it is more an open source or a free ware approach. It would not get so much attraction if it is not underpinned by IP because then you can not necessarily pull in other players. We would really love to bring at least a pilot case into practice and would be grateful for any support.

J.C. Wichard: We will certainly be very happy to explore that further with you.

F. Meienberg (Berne Declaration): More a general remark: I think everybody agreed, or at least all speakers agreed, that IP promotes innovation. But for me here the discussion should start: which IP system promotes best or is the most suitable? We heard from a lot of speakers that there are totally different IP systems in place. So, we heard from India that there are no patents on plants. We heard from South Africa it is UPOV 78. We heard from India it is neither UPOV 78 nor UPOV 91 and so on. So, we have very different IP systems in place. I think, everybody agrees that that is allowed under the TRIPS Agreement. We are allowed to have no patents on plants. We are allowed to have no patents on animals. We are allowed to have our own *sui generis* system. Now, my question would be if all the speakers agree that we have to keep this flexibility to allow all countries to really design their IP law in a way which suits best their needs. Or is there a danger to have one day a worldwide system, a one-fits-all approach, which might bring about much more negative impacts of intellectual property rights?

S. Kochhar: I have indirectly responded to that question by referring to the priority date issue. Because, if different jurisdictions are having different systems and the players have to act in different jurisdictions, again, that adds to the constraints. The basic purpose of having a common intellectual property regime was to facilitate operations. For example, the PCT is there for the patent system and provides a platform for quick decisions. For plant variety protection it is the UPOV system, ultimately, which has the distinction to provide such a platform for plant varieties.

S. Moephuli: I do not think there is a system that is perfect. I am now referring to the slide about the distribution of plant breeders' rights in South Africa: 60 per cent of them are from outside South Africa. That actually means that the breeders are residing outside South Africa and the research was done outside South Africa. You now have access to those particular varieties in South Africa in order for you to be able to produce a marketable product. But if you are a producer, such as a farmer of a protected variety from outside South Africa, this means you have incurred an input cost on the IP largely to a breeder from another country – an additional cost that should be avoided for lower food prices. You now have a cost that you need to pay to somebody else. Please compare that with a system where the breeder is internal to your country and your costs are localized to your currency. Then you are facing a very different input cost for your competitiveness if you are a commercial farmer, regardless of your farm size. In many instances that tends to be one of the key issues that we face as a developing country, how best to lower your input cost. We are finding that one of the issues arises within the context of having to pay royalty fees to those externals that own the plant breeders' rights. Now you are paying a much higher price than if they were locals, because the US Dollar tends to be higher than the local currencies in most developing countries. The question becomes, what system then would be most appropriate for your needs for food security and for your economic development.

M. Kock: If you look, for example, at our host country, Switzerland, you see that IP regimes have evolved. There might be different needs at different times during the development of a country. The tricky part, however, is how to ensure an incentive also to built a local innovation industry and, on the other hand, during this development period, not to overprize innovations coming from the external world. In my view the solution is not to decide whether you have patents or not, or whether you have plant variety protection or not, but to work rather on the technology dissemination mechanism, on the licensing mechanism to ensure that the access is on fair and reasonable conditions. Otherwise it is for my taste too black and white.

P. Button: Perhaps I should start by recalling that, for UPOV, it is entirely a matter for each country whether it chooses to adopt a system of plant variety protection based on the UPOV Convention and to become a member of UPOV. However, it is also important to note, and it is something that we found from the Impact Study, that there is a recognizable effect of international harmonization. It is important not to overlook the value of international harmonization, and in that regard becoming a member of UPOV certainly has been seen to have an important effect: breeders demonstrated that membership of UPOV was a matter of importance for them. As Dr. Moephuli explained, there is an international context and, therefore, international harmonization cannot be ignored. That is important. However, of course, it is always a matter for each country to decide whether it wants to have an internationally harmonized system or to develop its own *sui generis* system.

Dr. Marcel Bruins (ISF): I would like to strongly echo Peter's comments. International harmonization is not only important for plant variety protection but also for high quality seed. It applies also to seed certification, to seed testing. In fact, if you look at the world maps of those countries where there is an effective plant variety protection system in place, or an effective seed testing system in place, or an effective seed certification system in place, you see that those maps are virtual copies of each other. And if you then compare those world maps with the hunger map of the FAO you see that that is an almost negative copy of the membership maps of those internationally harmonized systems. In other words, in those countries where this enabling environment does not exist for the seed industry to operate, hunger is much higher. So, there is a clear indication that if you create a harmonized enabling environment with plant variety protection, with seed testing, with seed certification and with a good seed industry then you are doing something to alleviate hunger.

Closing remarks by Dr. Johannes Christian Wichard, Deputy Director General, Global Issues Sector, WIPO

- Achieving food security (in a sustainable manner) for a rapidly growing world population, against the background of climate change, requires an unprecedented increase in agricultural productivity;

- Joint efforts of all stakeholders are required to enhance plant related innovation and technology transfer to farmers in developing countries, in particular;

- Intellectual property protection (IP) has a considerable potential as a key enabler for innovation and technology transfer in agriculture;

- A suitable legal and administrative framework is a condition for an appropriate and effective application of various forms of IP for food security;

- Participants in the WIPO seminar have expressed their wish to cooperate in applying IP for food security;

- WIPO would be very pleased to provide not only a forum for further discussion, but also to act as a catalyst for practical cooperation with and among stakeholders;

- Therefore, WIPO intends to explore and encourage cooperation among stakeholders.

Speakers' Biographies

Dr. Shakeel Bhatti

Dr. Shakeel Bhatti is presently the Secretary of the Food and Agriculture Organization of the United Nations (FAO) International Treaty on Plant Genetic Resources for Food and Agriculture (IT-PGRFA). Before that, he worked at the United Nations in Geneva where he was Head of the Genetic Resources, Biotechnology and Associated Traditional Knowledge Section of the World Intellectual Property Organization (WIPO). Before joining WIPO, Dr. Bhatti worked on his doctorate at Duke University, USA, regarding 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 on bioethics, biotechnology patenting and the right to food.

Dr. Bhatti has taught international patent law and genetic resource policy at several universities in India, Japan and Sweden, including the National Law School of India University in Bangalore, Center for Intellectual Property Rights Studies of Cochin University, Swedish Agricultural University and at other institutions. He is a member of the Expert Group on Rights to Plant Genetic Resources and Traditional Knowledge at the World Trade Institute and the Social Science Research Council Expert Group on Intellectual Property Rights and Cultural Flows. His articles appear in several journals and books, such as the Handbook on Plant Biotechnology, published by Wiley and Sons.

Mr. Christophe Bellmann

Christophe Bellmann is the Programmes Director at the International Centre for Trade and Sustainable Development (ICTSD). Mr. Bellmann joined ICTSD in 1998, first as Programme Officer for Outreach and Partnership, then as Director of Policy Dialogues and finally, since 2002, as Programmes Director. In his current position, he is responsible for fundraising, management and overall supervision of ICTSD's research, dialogue and capacity building programmes in Geneva and in the regions.

Before joining our Organisation, Mr. Bellmann worked for the Swiss Coalition of Development Organisations (SCDO) where he was responsible for activities on multilateral trade and sustainable development issues. During that time he produced several papers and articles related among others to public participation in the World Trade Organization (WTO), possible multilateral disciplines on Foreign Direct Investment (FDI), trade preferences for developing countries, agriculture trade reform and trade-related technical assistance. Mr. Bellmann has also worked as a Research Associate at the Economic Commission for Latin America and the Caribbean (ECLAC) in Santiago, Chile, on the relationship between trade and the environment.

Mr. Bellmann has edited and published a wide range of books, articles and opinion pieces in English, French and Spanish on trade and sustainable development. He holds an MA in International Relations from the Graduate Institute for International Studies in Geneva. Mr. Bellmann is a citizen of Switzerland.

Dr. Stephen Mbithi Mwikya

Dr. Stephen Mbithi Mwikya (43) is the Chief Executive Officer of the Kenya Horticulture Industry association, known as the Fresh produce Exporters Association of Kenya (FPEAK), which brings together about 150 companies involved in production and export of fruits vegetables and flowers from Kenya to the EU (82%) and the rest of the world. Kenya's horticulture exports amount to one billion US$, which has been the largest forex earner for the last 3 years. 70% of export fruits and vegetables are produced by smallholders. Horticulture supports the economic livelihood of 4.5 million people in Kenya (11% of the country's population). It is a dynamic sector that is knowledge and technology intensive, and relies of superior cultivars and seed technology (with lots of intellectual property aspects) to enhance productivity and hence sustain global competitiveness.

Dr. Stephen Mbithi is a Ph.D graduate from University of Ghent in Belgium; specializing on Standards and postharvest technology. He is also the Coordinating CEO of the Horticulture Council of Africa (HCA), an umbrella body bringing together 13 horticulture industry associations across Africa. He also sits on the GlobalGAP sector committee (standard drafting) on fruits and vegetables, and has extensive knowledge on trade and SPS standards in public-private partnerships especially in horticulture and fisheries.

Dr. Shadrack R. Moephuli

Dr. Moephuli has been president and chief executive officer of the Agricultural Research Council (ARC), South Africa since 2006. He is a member of the Genetic Resource Policy Committee of the Consultative Group of International Agricultural Research (CGIAR), which is funded by the World Bank and member states. In the last 4 years he chaired the National Agricultural Research Forum, a multi – stakeholder consultative initiative.

Prior to joining the ARC, he served as acting deputy Director – General responsible for production and natural resource management in the Department of Agriculture, South Africa.

Since 2003 he served as the Chief Director for agricultural production in the same department. His responsibilities included developing and implementing policies and strategies for agricultural production, including agricultural research and development, as well as serving as technical advisor to the Ministry of Agriculture.

During the intervening period, he also served as the country's representative on various agricultural matters at the Convention for Biological Diversity (CBD), Cartagena Protocol for Biosafety (CPB), Food and Agriculture Organization (FAO), International Treaty for Plant Genetic Resources for Food and Agriculture (ITPGRFA), Organization for Economic Cooperation and Development (OECD).

Prior to joining government, Dr. Moephuli was a biochemistry lecturer at the University of the Witwatersrand, Johannesburg, South Africa. To his credit are a number of research publications, including invited speaking events. He obtained his doctoral degree from the University of Connecticut, USA.

Dr. Sudhir Kochhar

Dr. Sudhir Kochhar is currently National Coordinator in Program Implementation Unit (PIU) of National Agricultural Innovation Project (NAIP) in Indian Council of Agricultural Research (ICAR), New Delhi. He coordinates implementation of the World Bank financed, Component-4 Sub-Projects on Basic and Strategic Research in Frontier Areas of Agricultural Sciences. He is specialized in Plant Breeding and is trained in India and abroad in the fields of Plant Genetic Resources, Agrobiodiversity, Intellectual Property Rights, and Agricultural Research Management.

Dr. Kochhar's 33 years' scientific career starting with 2nd Batch of Agricultural Research Services (ARS-ICAR) includes work experience in diverse agro-ecologies (hills and plains), including most difficult tribal areas; various crops/fields (field crops, forages grasses, bamboos/research, coordination, middle-level management), and at various ICAR institutes – VPKAS, Almora, NDRI, Karnal, NBPGR, Shimla and New Delhi, ICAR-RC-NEHR, Arunachal Pradesh Centre, Basar, ICAR Hq, New Delhi, and PIU-NAIP, New Delhi.

Dr. Kochhar has worked in various capacities, including Project Coordinator (Acting), All India Coordinated Research Project on Underutilized and Underexploited Plants; Assistant Director General (Intellectual Property Rights) (Acting) at ICAR Hq, Counselor to the High Commission of India at Port Louis (on Deputation) under the Indian Technical and Economic Cooperation Program of Govt. of India, and Member Secretary, ICAR Committee to develop Intellectual Property and Technology Management Guidelines for the organization. He has attended various international programs and assignments in USA, China, Japan, the Netherlands, Republic of Mauritius, and Republic of Congo.

Dr. Kochhar actively contributed to the development of the Indian legislations, Protection and Plant Varieties and Farmers' Rights Act, 2001 particularly for assistance to the Joint Parliamentary Committee (JPC) that scrutinized the Bill; and the Biological Diversity Act, 2002; and he also contributed towards the Genetically Modified Organisms Act, 2004 of Republic of Mauritius. Dr. Kochhar is Member (*Amicus curiae*), NBA Expert Committee on Agrobiodiversity constituted under the Biological Diversity Act, 2002.

Dr. Kochhar's contribution to the development of *ICAR Guidelines for IP Management and Technology Transfer/ Commercialization* (2006) as Member Secretary of the Committee as well as Plant Breeder expert are well known.

Dr. Kochhar is Co-author of the *First National Policy Dialogue on PGR Management Policy Options* (1993); '*National Policy on Conservation, Management and Use of Agrobiodiversity*, (1998); and *National Action Plan on Agrobiodiversity Management in India* (1999). He also prepared First National Report on Agrobiodiversity in NBPGR, New Delhi. He has nearly 200 publications, including Research Papers/ Bulletins/ edited Books/ Book Chapters/ Book Reviews/Popular Articles, etc.

Dr. Kochhar is an acknowledged resource person and trainers' trainer in IPR in agriculture/ PVP, agrobiodiversity/ genetic resources. He has been a teacher and post graduate research guide at NBPGR and NDRI.

Dr. Kochhar is on the Editorial Board of the Journal of Intellectual Property Rights; Fellow, ISPGR and Life Member of 5 Professional Societies; and Alumnus of PRI, Wageningen, the Netherlands; JICA, India Chapter, New Delhi; and IIM, Ahmedabad.

Dr. Michael Andreas Kock

Dr. Michael Kock is Head Intellectual Property with Syngenta International AG in Basel, Switzerland.

Dr. Kock studied chemistry, biochemistry and molecular biology in Hamburg Germany and Nanjing, China and graduated with a Diploma in Chemistry and a Ph.D. in molecular biology. He worked as a laboratory and project leader in pharmaceutical industry research for several years before he focused on his career in IP. Prior to joining Syngenta he was Senior IP Counsel with BASF AG responsible for plant biotechnology and China IP matters. He is a qualified European Patent Attorney.

Dr. Marcel Bruins

Dr. 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 in Fusarium resistance in wheat at Plant Research International, he was awarded a PhD in 1998. After that he was responsible for the patent portfolio of a large public research institute for a number of years 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, like patents and trademarks. During this period he was a member of several international committees in organizations like the European Seed Association, the Dutch Seed Association and the International Seed Federation (ISF). He has been chairing several of these committees.

Dr. Bruins was hired at ISF for the position of Secretary General in 2007.

Mr. Peter Button

Mr. Peter Button was appointed Vice Secretary-General of UPOV on December 1, 2010, having previously held the role of Technical Director at UPOV since 2000.

Mr. Button, a national of the United Kingdom, holds a B.Sc. 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 1987and 1994 he was the General Manager of Twygen Ltd., a company which developed micropropagation 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, Mr. 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 United Kingdom representative in the UPOV Technical Committee.

Dr. Johannes Christian Wichard

Dr. Johannes Christian Wichard, a national of Germany, is Deputy Director General, Global Issues, of the World Intellectual Property Organization (WIPO) since December 2009. His responsibilities include WIPO's programs on Traditional Knowledge, Traditional Cultural Expressions and Genetic Resources, Intellectual Property (IP) and Global Challenges, IP and Competition Policy, Building Respect for IP, the WIPO Arbitration and Mediation Center, Small and Medium Enterprises, Communications, External Relations, and WIPO's relations with certain Countries in Europe and Asia.

Prior to joining WIPO, he was, from August 2006, Deputy Director General in the German Federal Ministry of Justice in charge of IP law and policy and other economic and commercial law matters. Between November 1998 and July 2006, Mr. Wichard had already worked at WIPO, first in the Industrial Property Law Division, then in the WIPO Arbitration and Mediation Center. Before that, he was Deputy Head of Section in the German Federal Ministry of Justice dealing with Trademarks and Unfair Competition since 1996, after a brief career in teaching and research at the Faculties of Law of the Universities of Tübingen (since 1989) and Berlin (as of 1995).

Mr. Wichard holds law degrees from the state of Baden Württemberg (Germany), a doctorate degree in law from the University of Tübingen, a master's degree from Harvard Law School, and was admitted to the New York Bar in 1993.

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OMPI
ORGANISATION MONDIALE
DE LA PROPRIÉTÉ
INTELLECTUELLE

WIPO/IP/LSBIOT/GE/11/INF.1
ORIGINAL: FRANÇAIS/ANGLAIS
DATE: 16 JUIN 2011/
JUNE 16, 2011

Séminaire sur la façon dont les secteurs privé et public utilisent la propriété intellectuelle pour accroître la productivité agricole

Genève, le 14 juin 2011

Seminar on How the Private and the Public Sectors Use Intellectual Property to Enhance Agricultural Productivity

Geneva, June 14, 2011

LISTE DES PARTICIPANTS/
LIST OF PARTICIPANTS

Établie par le Bureau international de l'OMPI/
Prepared by the International Bureau of WIPO

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