SECTION 2

OUTCOMES OF ABDC-10

CHAPTER 11

SUMMARY REPORTS OF SECTOR-SPECIFIC PARALLEL SESSIONS

11.1 INTRODUCTION

During the ABDC-10 conference, 27 parallel sessions were held over the first three days. Ten of these were dedicated to sector-specific issues and were organized by FAO, each lasting one hour and 45 minutes. Short summary reports were prepared after the sessions were terminated and each one was presented to the Plenary Session by a Rapporteur the following morning. This Chapter presents the summary reports of the ten sector-specific parallel sessions, five of which were dedicated to background documents and five to case studies of successful applications of biotechnologies in developing countries.

11.2 REPORTS OF SESSIONS ON SECTOR-SPECIFIC BACKGROUND DOCUMENTS

Before the conference, FAO published five sector-specific documents, covering the current status and options for biotechnologies in developing countries in crops, livestock, forestry, fisheries and aquaculture and, finally, in food processing and food safety. Each of the documents, published in Chapters 1 to 5 of these proceedings, was organized in two parts, the first focusing on learning from the past and the second on preparing for the future. These five parallel sessions were dedicated to the presentation and discussion of these documents. The proposed structure for each session was as follows: presentation of the document by an FAO staff member (15 minutes); "reflections on the document" by discussants (10 minutes each); and open facilitated discussion (70 minutes). The five presentations of the document, plus any presentations provided by discussants, are available at www.fao.org/biotech/abdc/parallel/en/.

11.2.1 Crops

Facilitator:
Karin Nichterlein, FAO Office of Knowledge Exchange, Research and Extension, Italy

Presenter of the document:
Andrea Sonnino, FAO Working Group on Biotechnology, Italy

Discussants:
Dominic Glover, Wageningen University, the Netherlands
Pat Mooney, Action Group on Erosion, Technology and Concentration (ETC Group), Canada
Eija Pehu, World Bank, United States

Rapporteur:
Denis Murphy, University of Glamorgan, United Kingdom

There were more than 100 participants and the following key issues for developing countries emerged from the background document:

Options for developing countries

- policy development;
- build up indigenous research programmes;
- development of regulation frameworks;
- link to strategies for dissemination;
- shared access to technologies;
- document development, adoption and impact.

Role of the international community

- assist in capacity development;
- offer assistance to public sector R&D in biotechnology;
- offer a meeting place for countries;
- facilitate access to technologies.

These points were further discussed, first by the three discussants and then in a general audience session, during which the following additional topics emerged:

Roles of governments

- address declining R&D investments in public sectors;
- form and/or support regional groupings, especially of smaller countries to achieve critical mass;
- target investments to small farmers;

- capacity building is still required;
- provide incentives for researchers to focus on smallholder problems rather than just academic outputs.

Roles of international organizations

- undertake basic R&D on behalf of developing countries;
- be more responsive to needs of small farmers and focus less on technology-driven programmes;
- address problem of seed laws favouring maximum yield rather than consistent yield under diverse stresses;
- address intellectual property rights (IPR) challenges, where appropriate;
- ensure linkages are made with farmers before sponsoring expensive R&D;
- establish and/or support broad regional/global priorities that may be beyond individual national capacities.

Participants were then invited to prioritize the options for developing countries, provided earlier, in an informal poll. The highest scores were for the following options in order of priority:

- build up indigenous research programmes;
- shared access to technologies;
- policy development;
- development of regulation frameworks.

11.2.2 Forestry

Facilitator:
Sandra Sharry, Universidad Nacional de La Plata, Argentina

Presenter of the document:
Oudara Souvannavong, FAO Forest Conservation Service, Italy

Discussants:
Jeff McNeely, International Union for Conservation of Nature (IUCN), Switzerland
Milton Kanashiro, Brazilian Agricultural Research Corporation (EMBRAPA), Brazil

Rapporteur:
Moisés Cruz, Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP), Mexico

In this session, the background document was first presented, two discussants then gave their reflections on the document and the floor was subsequently opened to the whole group for further discussion.

In considering the general topic of applying biotechnologies to forestry, an important point made in discussions was that national trade-offs in forest cover must be recognized, especially for those countries which are conserving their own forest cover while using

forest resources of other countries. One of these trade-offs is the potential of introducing exotic forest species which may become invasive. Some forest ecosystems are fragile while others are resilient, meaning that they can recover rapidly from disturbance or catastrophe.

There was general support for the Priorities for Action for the international community outlined in the background document. Two Priorities for Actions were highlighted in particular in the discussions:

Capacity building: Build capacity for understanding forest biotechnologies at all levels. The field of forest biotechnology and all its research needs are not the same as for agriculture, so capacity needs are different.

The group identified a large policy gap in forest genomics research in relation to tropical humid forests which are naturally regenerated and added a valuable suggestion: namely, the need to pair taxonomy with genus-level molecular identification. Implementing a range of policy measures such as forest certification, logging concessions, payment for avoided deforestation (reducing emissions from deforestation and forest degradation, REDD), would mean that reliable means would be available to identify tree species, or at least to identify the correct genus, using both living tissue and wood. However, currently this is not the case. As an example, it was mentioned that in a 100 ha Amazonian logging plot, there were 124 individuals identified under the common name of "tauari", yet after careful identification, it was shown that these individuals are from two different genera and five different species. Current taxonomy tools are just not good enough. Therefore, there is a need to put together several approaches/methodologies as well as have parataxonomists with strong training and skills at local community level. Short-term grants do not fill the need. Remedying this gap requires medium- to long-term sustained funding for an interdisciplinary team to work towards this knowledge and with the right tools. In short, policy-makers as well as the forest genomics community need to re-think the emphasis on within-species molecular tools in favour of among-taxon tools and work with field botanists. This gap between available research and global forest policy implementation must be remedied as soon as possible.

North-South collaboration: Support North-South collaboration, especially given that genomics in forest biotechnology is advancing faster than expected. Similarly, the group was enthusiastic about regional centres of excellence. These centres would bring into play South-South collaboration. This model is well suited to moving forest technology know-how into practice.

11.2.3 Livestock

Facilitator:
Gigi Manicad, Oxfam International, the Netherlands

Presenter:
Paul Boettcher, FAO Animal Production and Health Division, Italy

Discussants:
Arthur da Silva Mariante, Brazilian Agricultural Research Corporation (EMBRAPA), Brazil
Adama Traoré, Comité National de la Recherche Agricole, Mali

Rapporteur:
Harinder Makkar, University of Hohenheim, Germany

This session was attended by 32 people, in which the background document was presented and then two discussants gave their reflections on it. The floor was subsequently opened for a full facilitated discussion.

The group expressed appreciation for the comprehensive coverage of the livestock biotechnologies, their extent of application in developing countries and their usage in addressing emerging challenges. The participants agreed to the Priorities for Action for the international community listed in the document, and noted capacity building and enhancing quality of research as the most important Priorities for Action.

The gaps identified were lack of: 1) integration of traditional-, conventional- and biotechnologies, 2) capabilities and infrastructure for the conventional technologies upon which biotechnologies can be built, 3) appreciation for proper animal nutrition on which the success of animal reproduction and health programmes rests, 4) integration of biotechnologies in livestock development programmes, and 5) biotechnological options for pastoral production systems.

The future promising animal biotechnologies identified were: genome-wide marker-assisted selection, although, for this, phenotype and pedigree recording systems need to be first put in place and capacity in bioinformatics would need to be built to take full advantage; genome sequencing of host animal and rumen microbes and assigning the function to genes for increasing the utilization of fibrous feed and decreasing methane emissions from ruminants; development of strategies, for example, development of improved pastures and their introduction in grass and range lands for increasing livestock production and reducing methane emissions from pastoral production systems, and for increasing carbon sequestration; development of on-site cost effective, simple-to-use and interpret "dip-stick" or "pen-side" animal disease diagnosis tools; development and use of natural products as growth promoters; and development of enzymes and probiotics suitable for tropical feeds and tropical animals and better understanding of the situations for consistently eliciting increased productivity and decreased environmental pollution. Several participants also indicated that non-transgenic approaches for genetic modification of animals would soon be available, although there was no consensus on whether this technology would greatly impact farmers in developing countries

in the near future. In addition, it was noted that intellectual property issues can hamper the uptake of some biotechnologies, and recombinant vaccines were cited as a particular example.

The participants vehemently felt that the discussion on methane emissions by livestock in pastoral systems should consider and weigh the advantages it offers, for example for sustaining the livelihoods of people, and to the provision of animal protein and micronutrients for pregnant women and children from land which normally cannot be used for other more productive purposes. At the same time, the participants realized that reductions in methane from ruminants would be accompanied by increases in livestock productivity since a large proportion of feed energy is lost in methane. Any reduction in methane through better feeding strategies developed through conventional or biotechnological means would be a win-win situation for both farmers and the environment.

The need to establish genebanks for animal genetic resources; greater coordination among OIE (World Organisation for Animal Health), IPPC (International Plant Protection Convention) and the Codex Alimentarius Commission on issues related to biotechnology; and integration of business models while biotechnologies are being developed to ensure their accessibility to poor farmers, were highlighted. It was noted that some efforts are being made by national governments to use biotechnologies for animal disease control and eradication and to conserve animal genetic resources; however, there is a need to take similar actions for the application of biotechnologies in the area of animal nutrition.

Amongst various agricultural sectors, the greatest growth is taking place in the livestock sector and this sector plays a critical role in alleviating poverty and enhancing food security. National and international donors, policy-makers and science managers should recognize the importance of this sector and provide commensurate funding and support.

11.2.4 Fisheries and aquaculture

Facilitator:
María Cristina Chávez Sánchez, Unidad Mazatlán en Acuicultura y Manejo Ambiental, Mexico

Presenter of the document:
Matthias Halwart, FAO Fisheries and Aquaculture Management Division, Italy

Discussants:
Mohammad Pourkazemi, International Sturgeon Research Institute, Iran
María Cristina Chávez Sánchez, Unidad Mazatlán en Acuicultura y Manejo Ambiental, Mexico

Rapporteur:
Matthias Halwart, FAO Fisheries and Aquaculture Management Division, Italy

The quality of the document was appreciated but more comprehensive treatment of some areas was recommended. These included: population genetics for fisheries; molecular markers for sex, species or population identification; the use of cryopreservation for restocking; feed alternatives for carnivorous species; and the need to pay more attention to native species

with potential for culture. Biotechnology was considered to be a useful approach to assist the culture of such species through enhanced development of biological information on, e.g. physiology and nutrition, and improving performance in culture. Information from model species such as zebrafish would help this process.

The options for developing countries and several of the Priorities for Action identified for the international community as outlined in the document were generally considered adequate with the important addition that fisheries and aquaculture should be recognized and incorporated into national biosecurity plans. The important role of FAO was stressed in improving collection, analysis and dissemination of information on aquatic genetic resources as a baseline for developing national strategies. Although some aquaculture biotechnologies are still too technical and costly for small-scale farmers, principles of traditional animal breeding can be applied and could result in significant production gains without requiring additional farming systems, land or water. Traditional breeding schemes also provide important platforms for the effective application of biotechnology. The use of molecular markers for trade controls and traceability are relatively simple approaches that can markedly improve access to markets and the market value of products. The need for capacity building to use and implement biotechnologies at different levels was prioritized. A revised version of the document will need to take these points into account.

11.2.5 Agro-industry

Facilitator:
Masami Takeuchi, FAO Nutrition and Consumer Protection Division, Italy

Presenter of the document:
Rosa Rolle, FAO Regional Office for Asia and the Pacific, Thailand

Discussants:
Morven McLean, International Life Sciences Institute (ILSI) Research Foundation, United States
Marilia Nutti, Brazilian Agricultural Research Corporation (EMBRAPA), Brazil

Rapporteur:
Sridhar Dharmapuri, FAO Nutrition and Consumer Protection Division, Italy

In this session, which was attended by 25 people, the importance of upgrading fermentation bioprocessing through the improvement of starter cultures and bioreactor technology, was emphasized in presentation of the background paper. Schematic steps of an ideal fermentation process were outlined, following which the case of tempe fermentations was highlighted to illustrate that fermentation is only one step of a series of processing operations in the production of traditional fermented foods. Examples of "appropriate" and defined starter cultures applied in developing country food fermentations, and innovations in bioreactor technology were highlighted to illustrate the gradient of technologies that exist across the developing world. Lessons learnt and priority actions for governments and for the

international community were also outlined. The two discussants then gave their reflections on the document. The floor was subsequently opened for a facilitated discussion.

The utility of biotechnological tools was highlighted for strain and starter culture improvement, and for enhancing rapidity, efficiency and sensitivity in monitoring food safety. Growing importance of the use of the DNA bar code for traceability of fermented and non-fermented foods was also highlighted.

Participants added examples from Brazil, Japan and Nigeria to illustrate the growing consumer demand for fermented foods. The general discussion focused on the way forward for enhancing traditional fermented foods. Their market demand is being driven by changes in socio-economic conditions across the developing world and growing demand in international markets, which has been a driving force for their production in small and medium enterprises (SMEs), rather than at the household and village levels. An enabling environment for innovation through government support, capacity building in biotechnology, public-private partnerships and regional collaboration is essential for success. Intellectual property rights (IPR) is one of the important issues for both scientists and policy-makers and their crucial role must be addressed. An immediate need is the development of a prioritization tool that will help identify fermented foods for improvement based upon their major contribution to food security, their development potential and technical feasibility. An *ex ante* analysis and expert assistance supported by international organizations could be a starting point. This can be followed up with contextual research by national research institutions adequately supported by information sharing mechanisms between countries. As globalization advances and food chains are internationalized, biotechnological tools are playing a significant role in the improvement of traditional fermented products and their safety.

11.3 REPORTS OF SESSIONS ON SECTOR-SPECIFIC CASE STUDIES OF SUCCESSFUL APPLICATIONS OF BIOTECHNOLOGIES IN DEVELOPING COUNTRIES

As part of the "learning from the past" exercise at ABDC-10, the five sector-specific parallel sessions included the presentation of a small number of case studies of successful applications of biotechnologies in developing countries, followed by facilitated discussions. These provided an opportunity to evaluate the key factors responsible for the successful application of the biotechnologies concerned and thereby assist developing countries to learn from the past and empower them to implement appropriate biotechnologies more successfully in the future. Some of the case studies presented were described in the sector-specific documents (Chapters 1 to 5). The proposed structure of each session was as follows: introduction by the Facilitator (maximum five minutes); case studies of

successful use of biotechnologies in the sector (10 minutes each); and open facilitated discussion (70–80 minutes). All presentations from these five sessions are available at www.fao.org/biotech/abdc/parallel/en/.

11.3.1 Crops

Facilitator:
Karin Nichterlein, FAO Office of Knowledge Exchange, Research and Extension, Italy

Case studies presented:
1. Rhizobium-based biofertiliser for the common bean (Phaseolus vulgaris) in Mexico
   By Humberto Peralta, Universidad Nacional Autonoma de Mexico, Mexico.
2. New Rice for Africa (NERICA)
   By Sidi Sanyang, West and Central African Council for Agricultural Research and Development (CORAF/WECARD), Senegal

Rapporteur:
Denis Murphy, University of Glamorgan, United Kingdom

There were more than 100 participants and two case studies on biotechnology adoption in developing country crops were first presented. Additional cases of biotechnologies, already largely adopted, were then presented by participants from the floor and included:

- Mutation breeding – cassava in Ghana, rice in Vietnam;
- Micropropagation in sugar cane in India, banana in Ghana and Malaysia;
- Marker-assisted selection (MAS) in pearl millet in India, rice and water melon in Malaysia;
- Biofertilizers and entomopathogens in Cuba;
- *Bacillus thuringiensis* (Bt) pesticide sprays by local groups in India.

A general discussion then focused on the following key issues:

1. Factors that promoted the adoption of biotechnologies

- technologies that are of low cost, easy-to-use, and with a long shelf-life;
- contribution to improved crop and soil management;
- local provenance and/or ownership of technologies;
- ready access by R&D to government agencies and facilitation of regulatory issues;
- demonstrable improvement in socio-economic prospects of farming families.

2. Factors that inhibited the adoption of such biotechnologies

- mindsets of large numbers of often diverse farmers;
- burden of government regulation, especially for genetically modified crops;
- inadequate extension systems;
- cost of technologies;
- technologies that do not match farmer needs;
- difficulties when technologies require changes in agronomic practices.

3. Additional issues raised by participants

- Existing "low tech" options can sometimes be overlooked.
- Programmes should be needs-driven rather than technology-led.
- It is not always appropriate to focus on "high-tech" options.
- A greater role for public-public partnerships in developing countries and North-South partnerships needs to be explored.
- In many cases there will be important roles for public-private partnerships, especially in the latter stages of technology roll-out.

11.3.2 Forestry

Facilitator:
Sandra Sharry, Universidad Nacional de La Plata, Argentina

Case studies presented:
1. Tissue culture production of clonal teak in Malaysia
   By Doreen Goh, Sabah Foundation Group, Malaysia
2. Use of molecular tools for the management and conservation of forest trees in Central Africa
   By Dyana Ndiade-Bobouro, Centre National de la Recherche Scientifique et Technologique (CENAREST), Gabon

Rapporteur:
Moisés Cruz, Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP), Mexico

Two studies were presented, on the use of tissue culture for the large-scale production of elite planting materials of teak in Sabah, Malaysia; and on the use of molecular markers to study the population structure, diversity between and within individual species and to understand the population structure and dynamics of two native species in Gabon for conservation. Following the presentations, and based on them, the participants made the following observations and recommendations:

The participants supported the fact that North-South collaboration is one good approach for ensuring success of a project. Under such an approach, appropriate technology transfer is ensured, human resources are adequately trained and the projects adequately funded, and they generally are very focused with achievable targets. Participants also stated that the new tools of biotechnology should be integrated with conventional technologies, and that techniques like molecular markers and mass propagation could only be useful when a stable conventional forest breeding programme is already in place. Further, they were of the opinion that strong public-private partnership should be forged to ensure commercialization of the final products from the collaboration. This was clearly shown in the first case study by Doreen Goh on the commercialization of elite teak plantlets by the private sector.

Participants also agreed that there has to be a strong support by the government of each developing country towards including biotechnology in their science policies to encourage

such development to grow and flourish in their respective countries. They emphasized that the gap between scientists and policy-makers should be bridged to ensure integration of new knowledge into policies, regulations and programmes.

Lastly, the participants agreed that public access to goods and updated information on forest biotechnologies are very important. Benefits from their use can only be optimized if the end-users know how to utilize them properly. Consolidated information and education mechanisms should be put in place to allow communication between relevant sectors of society.

11.3.3 Livestock

Facilitator:
Gigi Manicad, Oxfam International, the Netherlands

Case studies presented:
1. Introduction of the FecB mutation to Deccani sheep in India
   By Chanda Nimbkar, Nimbkar Agricultural Research Institute, India
2. Community-based artificial insemination, veterinary and milk marketing services in Bangladesh
   By Mohammed Shamsuddin, Bangladesh Agricultural University, Bangladesh (presented on his behalf by Paul Boettcher, FAO Animal Production and Health Division, Italy)

Rapporteur:
Harinder Makkar, University of Hohenheim, Germany

Thirty delegates attended the session, in which two case studies were first presented. There was general consensus that both were good examples of how biotechnologies could help improve the incomes and quality of life of smallholder farmers. The commonalities between both case studies were that: 1) biotechnologies played a vital role but their impact at the farmers' levels could not have been generated without support mechanisms such as marketing, veterinary services, feeding, capacity building, and management; and 2) 10–15 years were needed to generate substantial impact at the end-users level. Based on this, it was recommended that biotechnologies should not be used in isolation, but integrated with conventional technologies and complemented by the provision of adequate logistic, infrastructural and institutional support. National and international donor agencies should have a long-term vision for the livestock sector and they should realize the need to support and fund programmes for a longer duration, although they should integrate activities to eventually aim for their self-sustainability.

Additional recommendations were:

- Farmer participation in the development and adaptation of a biotechnology must be considered.
- Mechanisms should be put in place to sustain biotechnologies.
- Governments need to develop national breeding policies to reap the benefits of cross breeding programmes. However, it was realized that such programmes may endanger local genetic resources, and proper measures must be taken to avoid this.

- The World Organisation for Animal Health (OIE) and other international agencies should consider giving more emphasis to the production diseases.
- For implementing biotechnologies and taking a successful biotechnology from one livestock production system to another, due consideration should be given to local conditions since particular biotechnologies might not be applicable in all situations.
- Indigenous knowledge and practices should be integrated into the development and use of animal biotechnologies.

11.3.4 Fisheries and aquaculture

Facilitator:
John Benzie, University College Cork, Ireland

Case studies presented:
1. PCR application for aquatic animal health management in Asia
   By Chadag Vishnumurthy Mohan, Network of Aquaculture Centres in Asia-Pacific (NACA), Thailand (presented on his behalf by John Benzie, University College Cork, Ireland)
2. Cryopreservation of freshwater fish species in Malaysia
   By Poh Chiang Chew, Freshwater Fisheries Research Centre, Malaysia.
3. Genetically improved farmed tilapia (GIFT)
   By Ravelina Recometa-Velasco, Central Luzon State University, the Philippines and Raul Ponzoni, The WorldFish Center, Malaysia (presented on their behalf by Matthias Halwart, FAO Fisheries and Aquaculture Management Division, Italy)

Rapporteur:
Matthias Halwart, FAO Fisheries and Aquaculture Management Division, Italy

Three case studies covering cryopreservation, polymerase chain reaction (PCR) based technologies, and genetic improvement of farmed tilapias provided examples where biotechnologies delivered key solutions for small farmers. They demonstrated that clear goals, sufficient time (several years) and long-term government support (to allow effective technology development, demonstration of value and uptake by farmers), the involvement of user groups from an early stage, and effective integration of the biotechnology with other aspects of the production system, were key factors behind their success.

In general, biotechnology uptake in fisheries and aquaculture has been limited, partly because of the relatively low biotechnology activity in the field, but where work has been done, because of the lack of involvement of end-users (industry, farmers) in project development and lack of effective extension efforts. Additional impediments are costs of research, intellectual property issues, lack of public sector investment, confusion of biotechnology with corporate agriculture, and concerns for environmental impact. However, the large potential for applying biotechnologies was identified.

The development of suitable national policies and legal frameworks to provide clarity for investors (private or public sector) will help adoption of biotechnologies, their downstream application and market acceptance. National policies can assist by providing

frameworks that have identified stakeholders, mechanisms for their inclusion in project planning, and major issues to be included in planning such as risk assessment, quality controls, extension requirements and market assessments. The inclusion of expert advice will allow improved integration of technology development with practical application and societal outcomes. These frameworks would help informed negotiation for access to investment, noting the need for developing countries to collaborate with developed countries or corporate entities. Additional specific elements identified were public education to enhance understanding of biotechnologies, and the use of collaborative collectives of small producers to access technologies.

11.3.5 Agro-industry

Facilitator:
Ruth Frampton, Critique Limited, New Zealand

Case studies presented:
1. Pozol - a Mexican fermented maize dough
   By Carmen Wacher, Universidad Nacional Autonoma de Mexico, Mexico
2. Mabí – a fermentated beverage in the Dominican Republic
   By Bernarda Castillo, Institute for Innovation in Biotechnology and Industry, Dominican Republic
3. Soy sauce production in Thailand
   By Ruud Valyasevi, National Center for Genetic Engineering and Biotechnology (Biotec), Thailand and Rosa Rolle (presenter), FAO Regional Office for Asia and the Pacific, Thailand

Rapporteur:
Sridhar Dharmapuri, FAO Nutrition and Consumer Protection Division, Italy

This session was attended by around 25 people. Three presentations were given related to traditional fermented products from developing countries. While pozol production has yet to be commercialized in Mexico, starter culture development in which a new strain of yeast isolated from the traditional beverage Mabí has been patented and licensed with the branded product, Bejuking, was seen as a local success story in the Dominican Republic. In contrast, soy sauce is internationally known and there is increasing market demand for this product. This has led to technological innovation through the development of starter cultures and bioreactor technology, leading in turn to improved consistency, quality and safety of the product as well as improved efficiency of the fermentation process. The drivers of innovation in this case were market demand and the support provided by international organizations, the Thai Government and the Thai Soy Sauce Consortium.

The case studies highlighted the potential of biotechnologies for improving traditional products produced in developing countries. It was recognized that without local and/or international market demand for fermented foods that are safe and of good quality, relatively little use would be made of the tools of biotechnology to upgrade fermentation processes. Another option would be to explore new market trends and create demand for fermented

foods, e.g. through promoting the neutraceutical, probiotic properties of fermented products. Discussion emphasized the importance of allocating resources for research to improve traditional products with appropriate cooperation ensuring benefit-sharing with indigenous people. Ideas for product improvement were identified as coming from researchers, processors experiencing problems, dissatisfied consumers and by way of meeting export market requirements. Cost-benefit analysis should supplement any research proposals.

CHAPTER 12

SUMMARY REPORTS OF CROSS-SECTORAL PARALLEL SESSIONS

12.1 INTRODUCTION

During the ABDC-10 conference, a total of 27 parallel sessions were held over the first three days, the majority of which were organized by different inter-governmental and non-governmental organizations. Each session lasted one hour and 45 minutes, except for three "double sessions" which lasted three and a half hours. Each organization arranging a session was asked to produce a short summary report from its session, which was presented to the Plenary Session by a Rapporteur the following morning. This Chapter presents the summary reports of the twelve parallel sessions dedicated to cross-sectoral issues.

For these sessions, FAO invited relevant inter-governmental and non-governmental organizations to organize sessions on a specific issue of cross-sectoral importance. For each one, the programme was developed by the organizers, with guidance from FAO. The structure that FAO suggested for each session was one with 2–3 speakers/panellists, each of whom would present for 15 minutes (providing a brief background on the topic and setting the scene) followed by an open discussion moderated by a facilitator. Presentations from the different sessions are available at www.fao.org/biotech/abdc/parallel/en/.

12.2 REPORTS OF THE PARALLEL SESSIONS

12.2.1 Development of genomic resources: Current status and future prospects

Organizer:
Consultative Group on International Agricultural Research

Facilitator:
Rajeev Varshney, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), India

Panel Members:
Roberto Tuberosa, University of Bologna, Italy
Jasper Rees, University of Western Cape, South Africa
Jerry Taylor, University of Missouri, United States

Rapporteur:
Michael Baum, International Center for Agricultural Research in the Dry Areas (ICARDA), Syria

Approximately 50 people attended this session, in which the three Panel Members provided background information on the availability of genomics resources in cereals, legumes, trees and animals. It was clear that access to low-cost, next generation sequencing technology will be, or is already, available for many cereal, legume, tree and animal species. To properly utilize this technology, major investments will be required in bioinformatics and data management. For the main cereal crops (wheat, rice, maize and barley), there is good availability of genomic resources and genomic platforms to identify genes/quantitative trait loci (QTLs) for target traits. New strategies such as association mapping have increasingly been deployed. Comparative genomics will play an increasing role for identifying and validating candidate genes following the availability of the sequences of important species such as rice, maize and sorghum, and many more species given the rapid increase in sequencing technology.

In legumes, due to coordinated efforts at national and international levels, a significant amount of genomic resources such as molecular markers, genetic maps, physical maps, genome sequence, and trait-linked markers have been developed in several important species. Tree breeding is challenging given the long breeding cycle, heterozygous germplasm and self-incompatibility. Currently, genetic maps for some fruit tree species such as apple are available and contain the location of various types of molecular markers and QTLs for important traits. Published genome sequences are available for grape and in an advanced stage for apple and peach. For cattle/animal breeding, high-throughput genotyping using the latest advances in genome sequencing is available and genome re-sequencing, *de novo* assembly, and mutation discovery are almost routine.

During the discussion, it was made apparent that developing countries should strongly consider investing in strategic partnerships with advanced research institutes to be in the

best position to take advantage of the latest technologies. If the technology exists for a species, gaining access to it and using it in research and breeding is feasible, either with investments in-house, or through partnerships or out-sourcing. It was also clear that there is a strong requirement for investment in capacity building – training and retaining human resources, especially in the area of informatics and data analysis/management. The correlation of genomic and sequencing data with phenotypic information is very challenging, but critical for the effective use of modern genomic tools. Data analysis, data management and data accessibility are most important when the "tsunamis" of genotyping data as well as phenotypic data become available. Finally, modern genomic information needs to be complemented with proper phenotyping, and this information needs to be converted into useful information (e.g. breeding values) so that breeders in developing countries can use this in their breeding programmes.

12.2.2 Genomic applications: Molecular breeding for developing countries

Organizer:
Consultative Group on International Agricultural Research

Facilitator:
Jean-Marcel Ribaut, Generation Challenge Program, Mexico

Panel Members:
Roberto Tuberosa, University of Bologna, Italy
Dave Hoisington, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), India
Carmen de Vicente, Generation Challenge Program, Mexico

Rapporteur:
Nicolas Roux, Bioversity International, France

Approximately 60 people attended the session, which started with the Facilitator reminding the participants that "molecular breeding" is perhaps not the most appropriate terminology since it sounds technology-driven and appears in conflict with conventional breeding. Therefore, it was suggested to use "modern breeding" to describe the use of genomic tools in breeding. Three presentations were given to provide background information and stimulate discussion. The first (by Roberto Tuberosa) laid out the overall strategies and options for applying molecular technologies in breeding. The second (by Dave Hoisington, Jean-Marcel Ribaut and Segenet Kelemu – presented by Dave Hoisington) discussed opportunities for providing molecular technology to research and breeding programmes via technology platforms and regional genotyping/biotechnology laboratories located in developing countries. The third (by Carmen de Vicente) presented studies on the potential impacts of molecular-based breeding and examples for capacity building and communities of practice toward the use of genomics in breeding.

From the presentations, it was clear that there are several opportunities for scientists in developing countries to access large-scale marker services, and therefore there is less need now to consider major investments in in-house technology. The need is now to build the capacity of scientists/breeders in developing countries to better understand how best to apply genomics in their programmes, including data interpretation and management.

The session was then opened to the participants for comments and discussion. A first point raised regarded the potential for intellectual property rights (IPR) to affect the ability to use molecular markers in breeding. In general, molecular markers are not patented, although some cases are known. In addition, while some institutes, even in the public sector, seek IPR on genomic technology, many of these do this to keep the technology in the public domain and make such technology freely available especially to developing countries. There was also a feeling that with the advent of large-scale genomics, less IP protection is being sought on the technology itself; however, the critical knowledge (e.g. about the linkage between a trait and a marker) is often not disclosed.

A few participants presented cases where national governments are supporting the establishment of national biotechnology laboratories, especially where the breeders/researchers are convinced of the potential impact of the technology. Some of these facilities are interested in providing services on a regional basis as capacity grows and needs increase.

While genomic resources are perhaps more advanced in animals than in plants (as presented in the previous session, described in Section 12.2.1), there was a comment that there is a limited ability within the animal breeding community of many developing countries to actually promote the use of modern technology as compared with the plant community. Unfortunately, the session lacked sufficient expertise in the animal sector to properly evaluate if this was a correct observation; however, there is a general lack of ability of breeders in all species to effectively use genomics.

Finally, enhancing the capacity of researchers and breeders in developing countries to understand when and how to use genomics in their programmes is a clear need. A "tsunami" of genomic data and information is coming. Therefore, effective data management and analysis systems will be critical and could become a major impediment for scientists in developing countries to use genomics optimally. Efforts should be initiated to ensure that the power of genomics is not lost as an option to improve global food and nutritional security.

12.2.3 Conservation and sustainable use of genetic resources for food and agriculture

Organizer:
Consultative Group on International Agricultural Research

Facilitator:
Dave Hoisington, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), India

Panel Members:
Tom Payne, International Maize and Wheat Improvement Center (CIMMYT), Mexico
William Roca, International Center for Tropical Agriculture (CIAT), Colombia
Arthur da Silva Mariante, Brazilian Agricultural Research Corporation (EMBRAPA), Brazil
Jean-Marcel Ribaut, Generation Challenge Programme, Mexico

Rapporteur:
Kay Simmons, United States Department of Agriculture, United States

This session, with around 45 participants, was started by the Facilitator noting that 2010 is the Year of Biodiversity and that safeguarding biodiversity is a recurring theme in the Conference, but that it was even more important to better understand and use biodiversity. The first presenter (Tom Payne) noted that many plant genetic resources are conserved and now biotechnology is helping to determine if a crop's gene pool is adequately conserved and how to better access that information. The second presenter (William Roca), on clonally propagated genetic resources, reported that biotechnology is revealing new information on potato species diversity and strengthening efforts to conserve farmer (native) genebanks. The third presenter (Arthur da Silva Mariante) noted that animal genetic resources are under-conserved and diversity is being lost due to the cross-breeding nature of animals. Thus, more conservation of animal semen and *in situ* conservation of breed animals are needed. The fourth presenter (Jean-Marcel Ribaut) described molecular methods to identify valuable subsets of genetic resources, to develop new diverse genetic resources using wide-hybridization and genomics, and to improve the use of genetic resources in crop improvement.

From the presentations it was clear that biotechnology is revealing even more value in conserving genetic resources and providing new tools to use biodiversity. The need now is to build the capacity of scientists/breeders in developing countries to better conserve their unique biodiversity and better access all available genetic resources. Participants, especially from Mexico, reported significant progress in developing a new genebank and *in situ* conservation. Several recognized that national priorities need to be determined and valuable resources used to conserve unique biodiversity and that genetic resources are in danger of being lost. It was also mentioned that the strategy for conservation and management of those resources might be quite different depending on the purpose. The conservation of species that are in danger of extinction is not the same as the species that have strong potential for large distribution on a regular basis.

Participants noted the need to conserve valuable genetic resources beyond plants including fish, animals, breeds, microbes and insects. A few participants suggested that a "Genetic Treaty" for genetic resources such as fish and other animals is needed, to enhance the use and benefit-sharing similar to plant genetic resources. Participants also recognized the need to pay attention to the management of "novel" genetic stocks (e.g. new genetic material produced from wide-hybridization, TILLING [targeting induced local lesions in genomes] etc.). The modality on how best to conserve and distribute these novel genetic resources requires further investigation. Finally, the need for the more advanced genebanks to share methods and technology to better preserve genetic resources in developing country genebanks was noted, and the importance of conserving unique biodiversity in all countries recognized.

12.2.4 Prioritizing the role of the farmer

Organizer:
FAO, with support from the International Federation of Agricultural Producers (IFAP)

Facilitator:
Karin Nichterlein, FAO Office of Knowledge Exchange, Research and Extension, Italy

Panel Members:
Herman Kumera, World Forum of Fisher Peoples, Sri Lanka
Miguel Altieri, University of California, United States
Isidoro Angcog, Asian Farmers Association for Sustainable Rural Development (AFA), the Philippines

Rapporteur:
Harinder Makkar, University of Hohenheim, Germany

About 44 people attended the session in which three presentations were made, focusing on the role of small producers (fishers and farmers) in R&D programmes to develop appropriate technologies. The group identified the following gaps:
1. R&D is not sufficiently addressing small farmers' needs; lack of public investment in R&D
2. Lack of:

- opportunities for farmers to participate in R&D priority-setting;
- national level consultative mechanism for farmers' participation in R&D work;
- information in local languages at the rural level, enabling informed decision-making by farmers;
- involvement of young people in identifying R&D programmes;
- recognition of farmers' knowledge and needs by researchers and policy-makers;
- skills with researchers to effective communicate with the farmers.

The group decided that the following steps should be taken to address these gaps:

- formulate national policies to address needs of small farmers and enable their active participation in R&D programmes.

- national governments should develop policies to oversee and monitor corporate R&D agendas involving farmers.
- farmers should be empowered with knowledge and information enabling them to prioritize their needs and to communicate them to decision-makers.
- mechanisms should be established to allow farmers participation in R&D priority-setting;
- R&D agendas should be driven by farmers' needs, and they should be involved from the very beginning - from planning and designing the R&D work to its execution.
- for developing R&D programmes, traditional knowledge and culture should be taken into consideration. The role of women in addressing this issue should be recognized.
- national R&D agencies and ministries should be proactive in approaching farmers to identify their needs and problems and develop R&D programmes to address them.
- international organizations should make the inclusion of small farmers' needs mandatory in programmes for providing financial and technical support.
- farmers' role in the form of farmer-to-farmer extension should be recognized as a promising strategy for wider dissemination and adoption of technologies. Researchers and extension workers would then play the role of only the facilitators.

12.2.5 Ensuring equitable access to technology, including gender issues

Organizer:
Oxfam International

Facilitator:
Gigi Manicad, Oxfam International, the Netherlands

Panel Members:
Luz Amparo Fonseca, Confederación Colombiana del Algodón (Conalgodon), Colombia
Patricia Zambrano, International Food Policy Research Institute (IFPRI), United States
Wilhelmina (Ditdit) Pelegrina, Southeast Asia Regional Initiatives for Community Empowerment (SEARICE), the Philippines
Andew Mushita, Community Technology Development Trust, Zimbabwe

Rapporteur:
Alvaro Toledo, FAO Commission on Genetic Resources for Food and Agriculture, Italy

In many farming communities worldwide, quite simply, no seeds mean no food. To examine the factors for the equitable generation and access of technologies with focus on women, the participants considered the following factors:

- role of international and national agriculture research systems in facilitating the steady and constant supply of genetic materials (parent breeding lines) so that farming communities can select and develop their own seeds under their specific conditions, which are constantly changing;
- complementary role of the formal seed systems for the supply of finished varieties, which farmers can test and select from;

- cooperation with research institutes for the use of biotechnologies (e.g. genomics, molecular assisted breeding) for the characterization and breeding of crops;
- market support to enable farmers to produce and sell their seeds and crops;
- capacity building approaches to help farmers organize, manage their seeds and production systems and engage in corresponding plant genetic resources policy development and governance;
- engaging women in the management of plant genetic resources.

This double session looked at the stresses and resilience of farmer seeds systems through three regional case studies: introduction of Bt cotton in Colombia (by Luz Amparo Fonseca and Patricia Zambrano); up-scaling and mainstreaming of participatory plant breeding of rice in Asia (by Ditdit Pelegrina); and ensuring farmers access and control of technology in Africa (by Andrew Mushita).

To ensure equitable access to technology, including women, the participants identified and recommended the following:

1. The role of women

There is an imbalance which needs to be corrected. On the one hand, it is important to recognize the significant role of women in household food security and biodiversity management. On the other hand, we need to understand and address the current marginalization of women by research and innovation systems; where women generally receive less information and are unable to participate in agenda setting. Moreover, women need access to institutional services such as credit, education and extension services.

2. Visions of farmers and technologies

We take a broader view of farmers and their multiple livelihoods. These include farmers, livestock producers, pastoralists, forest dwellers and fisher folks. Farmers are men, women, youth and community elders. Farmers too are researchers – they observe, experiment, and develop and adapt technologies. They are not just consumers, or end-users, of technologies.

For farmers, technologies should be easy to use, adopt and adapt in continuously-evolving farming systems and environments. Therefore, the technology needs to be continuously managed, owned, controlled and reproduced by small-scale farmers.

3. Farmers need to validate the technologies

These cannot be imposed top-down. For validation, accessibility of information is key. Information should be accurate and timely; gender-sensitive and relevant to farmers; complete, i.e. not only advertising but informing how to manage an innovation; and make the innovation visible.

4. Shared knowledge generation

- multi-stakeholder involvement (farmers, researchers, extensionists…);
- challenge the linear model of innovation (from vertical R&D to local hubs of innovation);
- increase the capacity for mutual learning and for the cogeneration of innovation;
- address empowerment of indigenous capacities for innovation.

5. Enabling Environments

Markets:

- affordable price of seeds/technology;
- assure market access, where appropriate;
- create opportunities for farmers-researchers to develop their products and add value to them.

Policies:

- access to credit by small-scale farmers;
- regulatory systems that enhance exchange of seeds and other practices:
  - non-restrictive intellectual property rights for small-scale farmers;
  - broaden scope of seed registration beyond yield;
  - seed and marketing laws that recognize farmers varieties;
  - crop insurance policies that cover farmers' varieties.

Institutions:

- ensure a rich multi-stakeholder environment.
- build solid institutions (credit, market, research).
- enable the generation and access to a diversity of technologies, crop varieties.
- strengthen farmers' organizations to access credit, demand research agenda.

12.2.6 Empowering public participation in informed decision-making

Organizer:
International Union for Conservation of Nature (IUCN)

Facilitator:
Keith Wheeler, IUCN Commission on Education and Communication, United States

Panel Members:
John Francis, National Geographic Society, United States
Sarah Stokes Alexander, The Keystone Center, United States
Joseph Russo, ZedX Inc., United States
Marcos Algara-Siller, Universidad Autónoma de San Luis Potosí, Mexico

Rapporteur:
John Francis, National Geographic Society, United States

Around 22 people participated in this double session which explored communication strategies that exercise a bottom-up, demand-driven approach to implementing biotechnology in agriculture. Four presentations were given in the first part of the session followed by a directed discussion with an audience of up to 22 people that continued into the second part. Keith Wheeler opened with the context of IUCN/CEC interest and activities including a brief mention of CEPA (communication, education and public awareness) methods and the challenge of effectively empowering stakeholders. John Francis talked about social networks and a broader conceptualization of the discussion about biotechnology solutions, arguing that everyone on the planet is an actor in agricultural production. This included a call for attention to communication at a grassroots level, including a greater range of participants and the use of emergent technologies to improve fund-raising and information exchange.

Sarah Stokes Alexander discussed how to enable dialogues among people with disparate outlooks and objectives, including recognizing where people are in their interests and capacity, encouraging listening and story telling, identifying common ground, and recognizing shared principles with a commitment to flexibility in solutions. Joseph Russo presented a web-based tool designed by ZedX for accumulating data and presenting it through user selected filters combined with real-time geographical information systems (GIS) information of value across a range of participants from local to international, grower to policy-maker. This includes the potential for real-time input of data from cell phones in the field with predictive, tailored information of value in the field, in the markets, in parliaments, and across a diverse web of actors. Marcos Algara-Siller provided an example of this tool in action with a detailed description of the Scope program, supported by the Mexican Secretaria de Agricultura and others where pest management data, such as the distribution of locusts, is mapped and provides real-time data to affected areas.

Following these presentations, questions posed to the audience included: How can we bridge the divides between research, policy, farmers, and the public?; How do we engage at all levels?; What tools and methods exist for groups to engage more with stakeholders?; What kinds of communication strategies are needed?; What are the relevant gaps and obstacles?

Salient conclusions included:

- For full engagement, especially including farmers in developing countries, researchers and policy-makers must hear and respond to the demands and needs at the local level.
- Solutions do not come as "one size fits all" and one must be aware of differing capacities and circumstances that lead to understanding and effective implementation with sensitivity about carefully selected and trusted messengers.
- Regional centres/approaches might better serve to streamline communication tailored to the audience.
- Starting early in schools with an understanding of agricultural systems and science can increase the likelihood of creating and adopting effective solutions.
- Use of new communications technologies should be embraced as soon as possible in those regions where practical.
- FAO and other international bodies need to financially invest in communications as key to engaging and empowering stakeholders and improving biotechnology implementation.
- FAO should play a role in supporting a global effort to enhance communications about biotechnologies through better coordination with communication and knowledge management specialists at regional and national levels.

12.2.7 Public-private partnerships

Organizer:
FAO, with support from the International Federation of Agricultural Producers (IFAP)

Facilitator:
Michael Baum, International Center for Agricultural Research in the Dry Areas (ICARDA), Syria

Panel members:
Francisco Aragão, Brazilian Agricultural Research Cooperation (EMBRAPA), Brazil
Jacob Mignouna, African Agricultural Technology Foundation (AATF), Kenya
Denis Murphy, University of Glamorgan, United Kingdom

Rapporteur:
Charles Spillane, National University of Ireland, Ireland

This session discussed cross-cutting issues, gaps and needs for successful agricultural public-private partnerships (PPPs) for smallholder farmers and highlighted successful PPPs, key constraints and needs. Case studies were presented on (1) development of herbicide tolerant soybean and virus resistant beans (BASF and EMBRAPA, Brazil); (2) development of water efficient maize for Africa (AATF); and (3) a wide range of agricultural biotechnology PPPs in the Malaysian oil palm sector. Other examples highlighted were agricultural biotechnology PPPs

for biofertilizer inoculants (Mexico), banana micropropagation (Kenya and Uganda), eucalyptus genetic improvement (Brazil), improved maize for African soils (Pioneer Hi-Bred, African national agricultural research systems) and vaccine development for domestic animals (Mexico).

PPPs can provide a mechanism to access and deploy biotechnologies for meeting the 21st century challenges and needs facing smallholder farmers. The private sector comprises many entities, ranging from small and medium sized enterprises (SMEs) and multinationals, to retailers, farmer cooperatives, and producer groups. Agricultural biotechnology innovations (and patents) arise from both the public and private sector. For innovations to reach and benefit smallholder farmers, it is important to identify needs, priority problems and engage target beneficiaries (e.g. farmers groups) for effective PPPs. The relative roles of public and private sectors in PPPs should ensure that the public sector does not undergo mission drift and begin competing with the private sector. Strengthening interfaces between public and private sector R&D can facilitate mutual understanding and more effective PPP management. Institutional capacity of partners to ensure stewardship of proprietary technologies can limit access, where technology providers fear reputational risk.

A key issue is whether regulatory systems for biosafety, intellectual property and seed systems are enabling agricultural biotechnology PPPs for smallholder farmers. High regulatory costs (for testing, production or marketing) can act as barriers to innovation, investment and smallholder farmer access to agricultural biotechnologies. Regulatory systems which are too strict, complicated, non-functioning or uncertain can all act as barriers to effective PPPs. Opportunities may exist for regional-level approaches to rationalize and harmonize regulatory procedures/frameworks to facilitate PPPs.

12.2.8 Biosafety in the broader context of biosecurity

Organizer:
FAO Nutrition and Consumer Protection Division, Italy

Facilitators:
Ruth Frampton, Critique Limited, New Zealand and Masami Takeuchi, FAO Nutrition and Consumer Protection Division, Italy

Panel Members:
Ruth Frampton, Critique Limited, New Zealand
Sridhar Dharmapuri, FAO Nutrition and Consumer Protection Division, Italy
Bertrand Dagallier, Organisation for Economic Co-operation and Development (OECD), France
Sol Ortiz García, Consejo Nacional de Ciencia y Tecnología (CONACYT), Mexico
Marilia Nutti, Brazilian Agricultural Research Cooperation (EMBRAPA), Brazil

Rapporteur:
Sridhar Dharmapuri, FAO Nutrition and Consumer Protection Division, Italy

Some weeks before the session took place, the organizers contributed a short Issue paper[1], focusing on the key topics to be discussed during the session, which was attended by 40

[1] Available at www.fao.org/fileadmin/user_upload/abdc/documents/biosecurity.pdf

people. “Biosafety in the broader context of biosecurity” generally refers to the safe use of new biotechnologies through management of biological risks associated with food and agriculture. The term “biosecurity” has been used by FAO to describe a strategic and integrated approach that encompasses the policy and regulatory frameworks for analyzing and managing relevant risks to human, animal and plant life and health, and associated risks to the environment. The value of the approach was recognized in the session.

In response to the introductory presentation, some participants suggested that the term “biosecurity” could be improved upon, given that currently “biosecurity” means different things in specific country contexts. FAO case studies indicated how this integrated approach may be used to rationalize decision-making around risk analysis. The benefit of identifying coordination mechanisms, yet using the existing institutional arrangements in the countries and the regions was highlighted. It was stressed that the approach should not add another layer to existing national structures.

One of the presentations highlighted that various biotechnologies being used in developed countries have potential to provide useful tools, such as pest/disease diagnosis and traceability tools in the implementation of risk management. At the same time, development and the use of some of the tools would require food and/or environmental safety assessments.

Examples of international efforts on biosafety were introduced by the OECD: one on environmental safety and one on food safety. Multilateral initiatives led by Mexico and Brazil to develop consensus documents were presented. OECD consensus documents are voluntary and risk-oriented guidance documents and are used by many countries and many sectors. The relationship, similarities and differences between OECD consensus documents and Codex texts were also discussed.

The various uses of the capacity building needs assessment tool in identifying gaps, avoiding inconsistencies and prioritizing actions were presented. It was particularly useful for cross-cutting capacity building since cost-effectiveness and usefulness of focused interventions were demonstrated through two case studies. Issues around biotechnology are cross-cutting and often require a multidisciplinary integrated approach.

12.2.9 Intellectual property rights in agricultural biotechnology

Organizer:
World Intellectual Property Organization (WIPO)

Facilitator:
Anja von der Ropp, WIPO, Switzerland

Panel Members:
Jorge Cabrera Medaglia, National Biodiversity Institute (INBio), Costa Rica
Raimundo Ubieta Gomez, Centre for Genetic Engineering and Biotechnology, Cuba
Decio Ripandelli, International Centre for Genetic Engineering and Biotechnology (ICGEB), Italy

Rapporteur:
Peter Gardiner, CGIAR Independent Science and Partnership Council, Italy

National and international agencies and organizations invest in the production of biotechnologies for the improvement of agriculture with high expectations as to accessibility of research results and products. Property rights establish ownership and influence access to, and the distribution and use of, the products and processes of biotechnological applications.

It remains to be established what kind of intellectual property (IP) legislation optimizes innovation and the dissemination of products. The current regulatory framework is complex. Several international instruments are relevant, such as TRIPS (the WTO Agreement on Trade-Related Aspects of Intellectual Property Rights), UPOV (International Union for the Protection of New Varieties of Plants), CBD (Convention on Biological Diversity), ITPGRFA (International Treaty on Plant Genetic Resources for Food and Agriculture) and a WIPO instrument under discussion. The flexibility within international instruments may build opportunities for national options to deal with different sorts of IP. Several countries have formulated IP protection systems based on their social and commercial needs. They include: "Common knowledge" varieties in national lists under Mexican seed law; the Brazilian Agricultural Research Cooperation (EMBRAPA) benefited from the existence of a comprehensive national IP policy since 1996 in negotiations with international providers of IP; and Cuba's IP law to protect national investments in biotechnology in the health and food security sectors. Equally important might be a pragmatic treatment of technology transfer using best practices and sound contracts.

New public-private partnerships are appearing that combine public sector research with private sector resources and development expertise, e.g. EMBRAPA-BASF. Similarly, there are initiatives to overcome difficulties in developing countries to access protected technologies, e.g. the African Agricultural Technology Foundation (AATF). There are also increasing opportunities for collaboration and augmentation of capacities by joining global (e.g. ICGEB) or regional networks.

There is a development away from seeing technology transfer from research institutions as simply a means of generating revenue, to ensuring product development that is of benefit

to society and dissemination of these products. IP management has to support strategic biotechnology goals at the institutional level. IP capacity needs to be improved to enhance the producers of biotechnology and not just treat developing countries as recipients.

Practical tools are needed to obtain information updates on IP and biotechnologies, and intelligent search engines to scan agricultural innovations (such as the patent landscape developed by CAMBIA with WIPO support).

12.2.10 Policy coherence in biotechnology at the national and regional levels: The experience of COMESA, ASEAN and CARICOM regions

Organizer:
United Nations Conference on Trade and Development (UNCTAD)

Facilitator:
Thomas Dubois, International Institute of Tropical Agriculture (IITA), United Kingdom

Panel Members:
Walter Alhassan, Forum for Agricultural Research in Africa, Ghana
Banpot Napompeth, Kasetsart University, Thailand
Wendy Hollingsworth, Policy NetWorks International Inc, Barbados

Rapporteur:
Gregory Jaffe, Center for Science in the Public Interest, United States

This session presented the experiences of the COMESA (Common Market for Eastern and Southern Africa), ASEAN (Association of Southeast Asian Nations) and CARICOM (Caribbean Community and Common Market) in developing regional and national biotechnology policies in agriculture.

The first presentation was given by Walter Alhassan, on behalf of Charles Mugoya and Michael Waithaka from the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) in Uganda. He discussed the regional activities that have been conducted by COMESA to harmonize biosafety policies related to genetically modified organisms (GMOs). COMESA has drafted guidelines and policies for handling commercial plantings of GMOs, trade in GM products, and emergency food aid with GM content. The regional work has also involved a biosafety roadmap to help national government establish biosafety frameworks, a communications strategy, and an analysis of the economic impacts on trade if the region grows GMOs.

The second presenter, Banpot Napompeth, provided the participants with a discussion of the current status of biotechnology development and biosafety regulation in the ten ASEAN countries. He explained that the countries ranged from having functional biosafety systems with commercial GMOs to countries with only an outline of their biosafety system and no research into GMOs. He also reported no regional activities in this area.

The final presenter, Wendy Hollingsworth, discussed the process that CARICOM has used to draft a regional biotechnology policy and strategy. She described a bottom-up approach involving stakeholder meetings in six representative countries and an effort to fit the regional policy within the content of other regional priorities, such as the regional agricultural policy. She ended with her thoughts on implementation considerations after the document is adopted by CARICOM.

The discussion focused on three general questions. First, the audience was asked about the general advantages or benefits to regional guidelines. The major points that were raised in the discussion were:

- efficiency (reducing costs and sharing resources);
- allow for regional trade;
- harmonization of technical requirements, regulatory procedures, and legislation;
- the fact that regional risk assessments could lead to approval in multiple countries;
- building and sharing capacity;
- incentive for product development, investment, market access.

The participants then discussed the hurdles to establishing regional guidelines. The points raised included:

- the fact that different countries are at different stages of development;
- countries want to maintain autonomy in the decision process;
- potential conflict with pre-existing laws and regulations;
- cooperation needed by different ministries;
- lack of a GMO product to test the system; the need for political commitment;
- the establishment of a regional secretariat to carry out the policy/guidelines (regional infrastructure).

Finally, the participants addressed which priorities that need tackling at the regional level. The interventions focused on:

- capacity building - human resources and also infrastructure;
- financial sustainability of the regional guidelines;
- an effective regional body;
- education of national decision-makers;
- quantitative (cost-benefit) analysis related to the value of the regional guidelines.

12.2.11 Utilization of plants for non-food uses: Challenges and perspectives

Organizer:
United Nations Industrial Development Organization (UNIDO)

Facilitator:
George Tzotzos, UNIDO, Austria

Panel Members:
Ivan Ingelbrecht, Ghent University, Belgium
Luis Herrera Estrella, Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional (Cinvestav), Mexico
Jonathan Gressel, Weizmann Institute of Science, Israel
Antonio Paes de Carvalho, Federal University of Rio de Janeiro, Brazil

Rapporteur:
Dulce de Oliveira, Ghent University, Belgium

There were 45 participants for this session. Ivan Ingelbrecht and Luis Herrera Estrella provided a general overview of non-food uses for plants, the former discussing the perspectives of the bioeconomy to address global challenges such as population growth and environmental degradation both in the OECD countries and sub-Saharan Africa, while the latter discussed the present and future applications of transgenic plants for non-food/feed uses. He highlighted added-value applications such as production of molecules of pharmaceutical and industrial uses, biodegradable polymers, biofuels, specialty oils, and also environmental sanitation applications such as bioremediation.

Jonathan Gressel and Antonio Paes de Carvalho are entrepreneurs in the field and presented two cases studies. The former presented the case study of genetic engineering marine microalgae for meeting global needs for feed and energy. He concluded that marine microalgae are excellent fishmeal substitutes; do not compete for land and water; can sequester industrial carbon dioxide; are efficient fertilizers; have high productivity; and can generate multiple products. However, to be used, microalgae need domestication for reliability, productivity and composition and this can be achieved via gene engineering. The latter presented the case study of the development of a biodiversity-related bioenterprise in Brazil. He discussed the different steps to adding pharma value to biodiversity from the regulatory background to market and return of benefits. He expressed the opinion that biodiversity-related biotechnology projects are an excellent mechanism to operate the transfer of technologies to farmers and to local biotechnology enterprises, and that biotechnology companies arising as spin-offs of academia in developing countries should be regarded as prime targets for high-tech biotechnology transfer to these countries. In this way, research, technological development and appropriate innovation would actually reach developing countries. He concluded that small biotechnology enterprises in developing countries share similar problems of growth with small farmers and should be treated accordingly by international organizations that purport to make biotechnology a tool to help the poor.

During discussion, the panelists and participants identified the following constraints for the adoption of "white" biotechnology:

- Current policies are not conducive for adding economic value to biodiversity and concomitant bio-business development.
- State funding and private venture capital are currently inadequate for bio-business development.
- There is considerable lack of awareness of the opportunities opened up by biotechnology for industrial applications.

The general conclusions from the discussion were:

- Non-food biotechnology applications are amenable for socio-economic development particularly in rural areas, provided they do not compete with food production.
- Increasing crop production is only part of the solution to reduce poverty. There is need to move away from subsistence farming to systems that make agriculture a vehicle for generating higher standards of living and thus better health.
- Biotechnology offers new opportunities to add value to genetic resources, and therefore inability to access genetic resources constitutes opportunity loss.

Recommendations to overcome the constraints identified and other concerns were:

- Industrial applications of biotechnology should not compete with food production.
- Non-edible products should preferably be produced in non-food crops. Food crops for the production of industrial products should only be used provided they do not compromise human and environmental safety. Adequate safety assessment on a case-by-case basis is a necessary pre-condition.
- Policies that promote the establishment of appropriate infrastructures for the adoption of new technologies through North-South and South-South partnerships should receive more attention by policy-makers and international donors.
- Initiatives for generating awareness about the opportunities offered by new technologies and the management of intellectual property assets should become a priority in capacity building programmes.

Although not explicitly referred to in this session, a recent initiative of UNIDO addresses the constraints and recommendations raised during the discussion. The International Industrial Biotechnology Network (IIBN) is dedicated to assisting countries in accessing and developing biotechnologies for sustainable industrial development. The goals of IIBN will be achieved by developing demand-driven projects; offering institutional capacity building through specialized training in research and areas deemed critical for product development and technology adoption; and raising awareness of governments and industry of the opportunities and challenges posed by the emergence of bio-based industries.

12.2.12 Enhancing human capacities: Training and education

Organizer:
International Centre for Genetic Engineering and Biotechnology (ICGEB)

Facilitator:
Roger Beachy, National Institute of Food and Agriculture, United States

Panel Members:
Godelieve Gheysen, Ghent University, Belgium
Idah Sithole-Niang, University of Zimbabwe, Zimbabwe
Jorge Allende, Universidad de Chile, Chile
Sudhir Sopory, ICGEB, India

Rapporteur:
Decio Ripandelli, ICGEB, Italy

This double session, attended by close to 70 participants, aimed to address some of the most urgent needs for building capacities in agricultural biotechnologies in developing countries, taking stock from past experience and looking into a new perspective determined by a number of scientific, socio-economic and cultural changes that have deeply affected the scientific environment.

Roger Beachy opened the session by providing the audience with some of the issues that in his opinion needed to be addressed, such as the need to educate more young scientists using, wherever feasible, the best tools available. He also emphasized that in the case of the developing world, it is essential that scientists apply the knowledge they acquire to solve the problems affecting their countries and that in the case of agriculture there must be a direct relationship between discovery and its relevant application in the field. Presentations by the Panel Members then followed.

Godelieve Gheysen provided a description of the training activities implemented by the Institute of Plant Biotechnology for Developing Countries (IPBO), and in particular the e-biosafety training which was developed in conjunction with the UN Industrial Development Organization (UNIDO). This programme is proving to be very successful, although it now needs some revision to maintain its attractiveness and overcome some challenges faced in the first years of operation.

Idah Sithole-Niang presented the MSc course in biotechnology developed in the last 20 years in her University, as well as the biosafety training activities implemented in collaboration with other regional and international entities, and in particular those developed in partnership with the Program for Biosafety Systems (PBS), with the mission of empowering countries for science-based biosafety.

Jorge Allende introduced the training programmes of his University. He then elaborated on some aspects relevant to the three major changes that, in his opinion, are influencing training of biotechnologists in the second decade of the 21st century –namely, a drastic

paradigm shift in the science of biology; an important geopolitical change among developing countries; and the increased need for interaction between science and society.

Sudhir Sopory described the training activities being undertaken by the ICGEB, as well as some of the forefront research being implemented in the ICGEB laboratories, upon which the same training activities are based. He then proposed some models to enable training programmes to tackle changes relating to the new generations of agricultural biologists and for mid-career scientists respectively.

The lively discussion that followed provided a wide spectrum of considerations and suggestions for future enhancement of capacity building activities. The following were considered as most relevant for future action by national governments, the FAO and other international and regional organizations:

- In parallel with the Biosafety Clearing House established by the Convention on Biological Diversity (CBD) Secretariat, FAO should establish a coordination mechanism that would allow all institutions providing educational training and capacity building in agricultural biotechnology to share their experiences and, possibly, define synergies for future actions (e.g. sharing success stories of governmental programmes aimed at stimulating the enrolment of young students in scientific faculties);
- In order to respond to society needs, universities and other training institutions should develop educational curricula that would allow future biotechnologists to be conversant on issues that are not directly related to their science, such as entrepreneurship, technology transfer, intellectual property rights etc., keeping in mind, however, the need to maintain different specialization, as a scientist needs to remain a scientist. The use of e-learning methodologies would also prove an asset in this respect.
- Enhance South-South cooperation initiatives such as those implemented by some of the "strongest" developing countries, or by the ICGEB, in collaboration with the Academy of Sciences for the Developing World (TWAS) and the UN Educational, Scientific and Cultural Organization (UNESCO), and other potential partners such as FAO, the CGIAR, as well as regional centres such as the Inter-American Institute for Cooperation on Agriculture (IICA), to ensure that collaboration among more proficient countries and scientifically lagging countries will eventually benefit the building of capacities in the latter.

CHAPTER 13

SUMMARY REPORTS OF REGIONAL PARALLEL SESSIONS

13.1 INTRODUCTION

During the ABDC-10 conference, a total of 27 parallel sessions were held over the first three days. Five of them were region-specific and, for these, FAO invited relevant regional organizations to organize parallel sessions for their region. The scope of each regional session was to address the potential role of biotechnologies for agricultural development in the region and to cover the entire range of biotechnologies across all the food and agricultural sectors. In addition, FAO suggested that it would be important to address both cross-sectoral and sector-specific themes and that, in this context, the strengths, weaknesses, opportunities and threats (SWOT) analysis method should be used to evaluate the SWOT in terms of the generation, adaptation and adoption of appropriate biotechnologies in the region. The organizers of each session were also invited to contribute an Issue paper providing a brief overview and potential analysis of the current SWOT to facilitate discussions during the session, with analysis in the paper covering three levels: strategy/policy options, institutional and human resources. The five Issue papers were made available on the web some weeks before the Conference, at www.fao.org/biotech/abdc/backdocs/en/.

Each regional session lasted one hour and 45 minutes and took place on 3 March 2010. The structure that FAO suggested to the organizers for each session was one with 1–2 speakers/panellists, each of whom would speak for 10 minutes (providing a brief background on the topic and setting the scene) followed by an open discussion moderated by a facilitator. All presentations from these five parallel sessions are available at www.fao.org/biotech/abdc/parallel/en/.

The organizers then prepared a short summary report from their session, which was presented to the Plenary Session by a Rapporteur on the morning of 4 March 2010. This chapter presents the summary reports of these five parallel sessions.

13.2 REPORTS OF THE PARALLEL SESSIONS

13.2.1 Latin America and the Caribbean

Organizers:
Inter-American Institute for Cooperation on Agriculture (IICA), the International REDBIO Foundation and the Technical Cooperation Network on Agricultural Biotechnology in Latin America and the Caribbean (REDBIO)

Facilitator:
Michelle Chauvet, Universidad Autónoma Metropolitana, Mexico

Panel Members:
Rodomiro Ortiz, international consultant, Peru
Moisés Burachik, Ministry of Agriculture, Livestock and Fisheries, Argentina
Arthur da Silva Mariante, Brazilian Agricultural Research Corporation (EMBRAPA), Brazil

Rapporteur:
Bryan Muñoz, IICA, Costa Rica

An Issue paper was prepared prior to the meeting, and is available at: www.fao.org/fileadmin/user_upload/abdc/documents/iicaredbio.pdf. During this parallel session, attended by over 65 people, three presentations were made in the first part of the session by experts in crop breeding and biotechnology, biosafety, and animal research. For the second part of the session, guidelines for SWOT analysis and priorities were provided for discussion.

Rodomiro Ortiz opened the session with a summary of the relevant advances made in traditional and modern crop genetic improvement assisted by biotechnology in Latin America. He noted that agro-biotechnology implies a direct relationship between the private sector, government and researchers; and that human resources, technology and expertise should be shared and optimized through national and regional integration including research networks, in order to maximize the potential of the region.

Moisés Burachik emphasized that biosafety regulation needs to be understood as a scientific process, and that the expertise and proficiency of human resources are essential to accomplish this task. To be strong as a region it is important to define harmonized regulatory processes that will have to include all the most relevant aspects that are within the region's best interests without overlooking national interests, but of course some concessions need to be made. Also reaching a workable consensus as a region before the international community and international fora is as important.

Arthur da Silva Mariante highlighted the importance of traditional biotechnology over transgenesis in the field of animal breeding. Artificial insemination is probably the most widely used biotechnology in animal science for Latin America. Moreover, some countries have had great advances in embryo transfer and cryogenesis. However, the lack of equipment, information about breeds, and trained technicians are still the greatest challenges.

During the second part of the session, the group concluded that Latin America is rich in biodiversity and natural resources (including aquatic and animal resources); is a

world's supplier for genetically modified (GM) seeds and food/feed crops products; and has several functioning networks of experts. On the other hand, the region is still in great need of capacity development for human resources and tools; GM seeds and the food/feed market are controlled by few companies; and the high cost of biotechnologies and biosafety regulation make it difficult for poor farmers to access them.

During the session, the absence of the English-speaking Caribbean countries in the Latin American regional networks was noted, and that there is still debate about transgene flow, especially for countries that are centres of origin or mega diverse.

The group also strongly emphasized that one of the greatest weaknesses in the region is the lack of coordination between the Ministries of Agriculture and the Environment. This situation makes it difficult to define a clear policy on biotechnology and biosafety and, as a clear consequence, hinders its development.

SWOT analysis

Strengths	Weaknesses
• Latin America and the Caribbean (LAC) has greater biodiversity and natural resources than other regions in the world. It is also rich in aquatic resources. • REDBIO/FAO is a consolidated network functioning in LAC. • Regional and sub-regional networks in LAC are an important asset to share knowledge and expertise in genetic resources management and biotechnology. • LAC has a significant critical mass of experts in biotechnology. • The Southern region is a major supplier for GM cereals and oil seeds and food/feed products.	• There is still a need for capacity development of human resources and institutions working in biotechnology. • There are difficulties in performing monitoring after field release, mainly in countries that are centres of origin. • Different opinions in Ministries of Agriculture and Environment make it difficult to reach agreement in developing biotechnology for the region. • English-speaking Caribbean countries do not participate in most of the networks functioning in Latin America
Opportunities	**Threats/Challenges**
• There is opportunity for horizontal cooperation between countries, including South-South cooperation. • The Southern region is in a strong position to negotiate in the GM oil seeds and cereal markets. • There is an aquaculture network that can be used to explore the possibilities of using biotechnologies in aquatic resources. • There is willingness to work towards the development of biotechnologies. • To advance in participatory communication/information of biotechnology and biosafety	• Avoiding the potential for transgene flow, especially in centres of origin and mega diverse countries. • Transgenic seeds are being controlled by a few companies. • High costs of the technologies make it difficult for poor farmers to acquire them. • Disagreements within the scientific community hinder the development of biotechnologies. • Over-regulation of modern biotechnology can raise the costs or even block research and release of products developed by the public sector.

Priorities

Before concluding the session, the group decided what actions should be priorities of FAO for Latin America and the Caribbean, in order to advance biotechnology. The following were identified:

- strengthen existing knowledge sharing and research networks and platforms in biotechnology;

- develop training programmes and tools in biotechnology and biosafety (e.g. risk assessment, molecular techniques, animal breeding, molecular markers, etc.);
- harmonize methodologies and legislation in biosafety;
- generate and promote consultation mechanisms for decision-making in biotechnology and biosafety;
- establish communication channels and science-based information in biotechnology and biosafety that promotes ample participation and technology transfer;
- promote a regional position on biotechnology and biosafety at international fora;
- coordinate existing biotechnology and biosafety databases.

13.2.2 West Asia and North Africa

Organizer:
Association of Agricultural Research Institutions in the Near East and North Africa (AARINENA)

Facilitator:
Alex Percy-Smith, University of Aarhus, Denmark

Panel Members:
Osama Momtaz, Agricultural Genetic Engineering Research Institute (AGERI), Egypt
Ahmad Abdul Kader, General Commission for Agricultural Scientific Research, Syria
Michael Baum, International Center for Agricultural Research in the Dry Areas (ICARDA), Syria

Rapporteur:
Osama Momtaz, AGERI, Egypt

An Issue paper was prepared prior to the meeting, and is available at www.fao.org/fileadmin/user_upload/abdc/documents/aarinena.pdf. This session was attended by 17 participants and the speakers set the scene for discussions. The session presentation was divided into three parts.

The first part, by Osama Momtaz, dealt with the characteristics of the West Asia and North Africa (WANA) region with several development problems, among them poverty, lack of gainful livelihoods, shortage of water, droughts and desertification, and conflicts. It also included the AARINENA mission in contributing to the enhancement of agricultural and rural development in the WANA region through fostering agricultural research and technology development and promoting the exchange of scientific and technical experience and information, as well as strengthening collaboration within and outside the region to achieve a greater degree of self-reliance in food and agriculture. It also reported on the geographical distribution of the AARINENA Networks and reviewed the current status of biotechnology application in the WANA region. The second part of the presentation was delivered by Ahmad Abdul Kader and dealt with the SWOT analysis for agricultural biotechnology in the region. The third part of the presentation was delivered by Michael Baum and dealt with the SWOT analysis for livestock biotechnology in the WANA region.

SWOT analysis

The WANA region can subscribe to many of the points discussed in other sessions of the Conference. However, a quick region-specific SWOT analysis carried out during the discussion led to the following main results:

Strengths	Weaknesses
• The region has some well-equipped laboratories and some trained personnel. • An agri-biotechnology network exists. • The region has several centres of biodiversity. • The region also has some centres of excellence.	• In the region, there is a general lack of public awareness and poor communication about biotechnology. • There is a lack of regional cooperation in this very heterogeneous region. • There is a lack of harmonization of biosafety regulations and a lack of risk assessment and management expertise. • Livestock and fisheries are increasing in demand but there is a lack of focus on these sectors. • There is a lack of integration of technologies into breeding programmes • There is a lack of product development skills.
Opportunities	**Threats**
• International organizations are in a strong position to contribute. • There is a considerable potential for private sector involvement. • Similar problems within the region mean that solutions may be shared. Developing regional projects to address shared constraints such as water scarcity, would strengthen the region. • Develop a regional biosafety regulatory framework tailored to national priorities. • More R&D is required based on demands from broad stakeholder groups. • Integrating the best outputs of agricultural biotechnology into conventional national breeding programmes should remain the major direction.	• Political instability and the socio-economic situation may be a threat in the region. • The region is the centre of origin for many species, therefore there is a risk posed by genetically modified organisms (GMOs) on biodiversity. • Intellectual property rights are a matter of concern. • There is an absence of regional policy and national strategies, setting priorities addressing the use and integration of biotechnology in the agricultural sector with lack of cooperation, dialogue among the different stakeholders including academia, research, industry, private sectors and government. • Biosafety systems are not fully operational in many countries and are not harmonized in the region. • There is a lack of national and international funding. • Tools for technology transfer are inadequate and often inaccessible.

The SWOT analysis was then translated into an outline for a priority action plan.

Preliminary priorities for action plan in agricultural biotechnology in WANA

- map and assess available resources and capacities;
- identify the gaps;
- evaluate national strategies to introduce biotechnology into research programmes;
- prioritize a product of interest for the region;
- direct capacity building for human resources in the field.

This action plan must be further developed.

13.2.3 Sub-Saharan Africa

Organizer:
Forum for Agricultural Research in Africa (FARA)

Facilitator:
Idah Sithole-Niang, University of Zimbabwe, Zimbabwe

Panel Members:
Jane Morris, African Center for Gene Technologies, South Africa
Adama Traoré, Comité National de la Recherche Agricole, Mali

Rapporteur:
Jacob Mignouna, African Agricultural Technology Foundation (AATF), Kenya

An Issue paper was prepared prior to the meeting, and is available at www.fao.org/fileadmin/user_upload/abdc/documents/fara.pdf. There were around 80 participants in the session.

Priority actions for sub-Saharan Africa

The group discussed and identified many priority areas for interventions. However, there is a need to maximize the use of resources. Therefore, out of 15 priority areas identified, namely: Human Resources and Infrastructure Development (5), Technology (4), Policy (4), Priority Actions for International Community (2), the following are considered to be the key priority areas at the present time:

- provide resources to establish and manage a biotechnology laboratory of excellence in West Africa;
- train in molecular techniques for breeding against climate change;
- use biotechnology for value addition and mitigation of post-harvest losses;
- harmonize biotechnology/biosafety regulations and trade agreements.

Institutional arrangements for implementation

FARA in collaboration with its stakeholders:

- sub-regional organizations;
- national agricultural research systems;
- farmer-based organizations;
- private sector;
- biotechnology supporting institutions in Africa (AATF, Africa Harvest Biotech Foundation International, International Service for the Acquisition of Agri-biotech Applications etc);
- development partners;
- extension services.

13.2.4 Asia-Pacific

Organizer:
Asia-Pacific Association of Agricultural Research Institutions (APAARI)

Facilitator:
Sudhir Sopory, International Centre for Genetic Engineering and Biotechnology (ICGEB), India

Panel Members:
Jawahir Karihaloo, APAARI, India
Chanda Nimbkar, Nimbkar Agricultural Research Institute, India

Rapporteur:
Tashi Samdup, Council for Renewable Natural Resources Research of Bhutan (CoRRB), Bhutan

An Issue paper was prepared prior to the meeting, and is available at www.fao.org/fileadmin/user_upload/abdc/documents/apaari.pdf. Two presentations were given that provided background to the session topic. The first was on "Harnessing crop biotechnology for food security in the Asia-Pacific region" by Jawahir Karihaloo. The second was on "Biotechnologies in livestock, poultry, fisheries & aquaculture in the Asia-Pacific region" by Chanda Nimbkar (presented on behalf of Oswin Perera, University of Peradeniya, Sri Lanka and Chanda Nimbkar). These highlighted some successes at the field level application of biotechnology in crops, livestock, and fish and aquaculture in the region. They included application of micropropagation, marker-aided selection, mutation and haploidy breeding, and GM technology in crops with proven benefits to farmers and other stakeholders. Similarly, in the livestock sector, cryopreservation and artificial insemination have been adopted with success in several countries and have resulted in improved milk yields. Biotechnological tools are being used extensively in the production of vaccines and diagnostics.

During the discussion, the participants recounted more success stories, also mentioning that there are considerable strengths in biotechnology R&D in some Asia-Pacific countries, including region-based international centres, which need to be harnessed for the benefit of the entire region.

The SWOT analysis revealed the following constraints:

- policy support not very conducive in many countries;
- limited and unsustained funding for biotechnology R&D;
- limited capacity (technology, technology adaptation and adoption, regulatory and intellectual property (IP) issues, communication) in many countries, especially in small island nations;
- less attention being paid to livestock and fishery biotechnology;
- limited public awareness and difficulty in dealing with IP issues;
- regulatory management systems need streamlining

Based on an in-depth analysis of the SWOT, the following recommendations were made for priority actions:

Create an enabling environment

- extend and enhance policy and funding support to biotechnology R&D;
- adopt need-based biotechnology tools and techniques, and integrated strategies and package of practices to improve small farm-level productivity and profitability;
- adopt IP and benefit-sharing policies appropriate to the need to protect farmers' and consumers' interests.

Build capacity

- strengthen, with support from FAO and other donor agencies, some existing national institutions to serve as Regional Hubs for sustained capacity building, especially in education;
- collaborate in regional and interregional capacity building through support of national agricultural research systems, CGIAR (Consultative Group on International Agricultural Research) centres, ICGEB, and regional fora like APAARI.

Improve regulatory management

- adopt biosafety regulatory systems based on robust science and transparent approval processes;
- facilitate transboundary movement of biotechnology products through bilateral and regional arrangements including agreed biosafety information requirements and data acceptance.

Enhance awareness through education and communication

- develop educational tools, status reports and web-based information systems;
- include biotechnology and agriculture oriented courses in school syllabi;
- train scientists not just in the field of biotechnology but also on issues of agriculture and food security, environment safety and in communication skills;
- organize dialogues between scientists, civil society organizations, farmers' organizations and consumer groups.

Strengthen linkages

- foster regional linkages within the Asia-Pacific region; South-South linkages; North-South linkages; public-private linkages; public-public linkages;

- draw on existing regional fora like APAARI, AARINENA, FARA and networks to develop linkages;
- conduct workshops to define available resources and needs, followed by mutually agreed work-plans.

13.2.5 Europe and Central Asia

Organizer:
FAO Regional Office for Europe and Central Asia

Facilitator:
Joachim Schiemann, Federal Research Centre for Cultivated Plants, Germany

Panel Members:
Atanas Atanassov, Black Sea Biotechnology Association, Bulgaria
Guy Van den Eede, European Commission Joint Research Centre, Italy

Rapporteur:
Joachim Schiemann, Federal Research Centre for Cultivated Plants, Germany

An Issue paper was prepared prior to the meeting, and is available at www.fao.org/fileadmin/user_upload/abdc/documents/eca.pdf. Although having experienced a similar historical past under the former centralized political system, the countries of the Eastern European and Central Asian (ECA) region are now facing considerable divergence with regard to development and implementation of their national biotechnology and biosafety strategies, policies and, when necessary, regulatory frameworks. These biosafety policies, drafted or officially adopted and existing often only on paper but not implemented, are hardly embedded in a larger context of a sustainable biotechnology strategy. Almost all ECA countries failed in developing or enforcing functional frameworks that allow taking advantage of a wide range of biotechnologies and particularly to bring locally developed biotechnology inventions into farms and on the market.

The countries from ECA have traditionally good secondary and higher education systems, which address different aspects of biotechnology research in crops, forestry, livestock, fisheries and food. The transition period in their economies, however, severely influenced the process of depletion or loss of intellectual and technical personnel, especially in the young generation. The disinclination of policy-makers to implement adequate strategies for prioritizing biotechnology research, or adopting too restrictive, over-regulated biosafety legislation caused additional reflux of highly qualified young experts from a biotechnology vocation.

During the session a priority list of actions for the Region, the European Union (EU) and international organizations was developed and discussed. Some actions defined are specific for the region, the EU or international organizations, while others may concern all players.

For the region

- develop and implement a national strategy for agricultural biotechnology in every country of the region;
- establish and make effective use of competent biosafety authorities in every country for independent and science-based environmental risk assessment;
- improve and strengthen East-East cooperation by establishing regional centres of excellence, exchange of genetic resources and methodologies;
- set priorities for R&D in biotechnology, focused on local strengths and needs.
- develop and implement educational programmes on biotechnology, biosafety and intellectual property rights;
- develop and implement strategies for science-society communication to raise public awareness on agricultural biotechnologies;
- provide conditions that local biodiversity is fully explored in breeding programmes.

For the EU

- the EU is seen as a role model by many countries of the region. Therefore, attention should be paid to base political decisions on verifiable scientific data; to implement agricultural biotechnology developments; and to execute regulatory procedures in a consistent and timely manner.
- support technology transfer, coupled with capacity building on intellectual property rights.
- support the establishment of public-private/public-public partnerships in biotechnology research and innovations in agriculture by exploring existing technology platforms like "Plants for the future".
- improve the awareness and participation of research institutions and SMEs (small and medium sized enterprises) located in the region in EU-funded research programmes on agricultural biotechnology.

For international organizations

- support networking in the region and internationally.
- support capacity building in agricultural biotechnology research, extension, application, and communication with focus on the needs of farmers of the region.
- advocate for the establishment of national strategies for agricultural biotechnologies in every country in the region.

CHAPTER 14

KEYNOTE PRESENTATIONS

14.1 INTRODUCTION

This Chapter contains four keynote presentations prepared for the ABDC-10 conference. The first two are the introductory remarks made by the representatives of FAO and the Government of Mexico respectively at the Opening Ceremony on 1 March 2010. They were presented by Mr. Modibo Traoré, Assistant Director-General, Agriculture and Consumer Protection Department, for FAO and by Mr. Mariano Ruiz-Funes Macedo, Sub-Secretary of the Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA), for Mexico. The statements are provided in the original language in which they were presented. The third presentation is the keynote address prepared by Mr. M.S. Swaminathan, Chairman of the M.S. Swaminathan Research Foundation (Chennai, India) and Honorary Chair of the ABDC-10 Conference Steering Committee, which was read by a representative of FAO at the Opening Ceremony. The fourth presentation is the paper prepared by Mr. Rodney Cooke, Director of the Operational Policy and Technical Advisory Division of the International Fund for Agricultural Development (IFAD). The paper is entitled "Investing in agricultural research and agricultural biotechnologies" and was presented to the Plenary on 2 March 2010.

14.2 MODIBO TRAORÉ, FAO

Mr Mariano Ruiz-Funes Macedo, Sub-Secretary of Agriculture, SAGARPA,
Mr Alvaro García Chávez, Secretary of Rural Development, State of Jalisco,
Members of the Steering Committee,
Honourable Delegates,
Colleagues,
Ladies and Gentlemen,

It is my great pleasure to be with you today and to welcome you all to the FAO International Technical Conference on Agricultural Biotechnologies in Developing Countries. I want to begin by thanking the Government of Mexico for hosting this event in such a beautiful

city, Guadalajara. I also thank our partners in this initiative including SAGARPA, IFAD, CGIAR, GFAR, ICGEB, and the World Bank. On behalf of the FAO Director-General, Dr Jacques Diouf, I thank all of you for your support and commitment for bringing together the policy-makers, scientists, civil society, and private sector from our member countries to explore the options and opportunities from biotechnologies for food and agriculture in order to face the challenges of food insecurity, climate change, and natural resource degradation.

A major objective of this Conference is to take stock of the application of biotechnologies across the different food and agricultural sectors in developing countries. We expect to learn from the past successes and failures and chart a better course for the future. The timing for this dialogue is very opportune as it is taking place in the wake of the Declaration of the World Summit on Food Security held last November at FAO headquarters – which noted that agriculture in the 21st century faces multiple challenges for doubling food production by 2050, particularly in developing countries. Concrete and appropriate tools and technologies are needed to underpin national investments and implementation of appropriate policies for addressing these challenges[1].

Modern and conventional biotechnologies provide potent tools for the agriculture sector, including fisheries and forestry. When appropriately integrated with other technologies for the production of food, agricultural products and services, biotechnologies can be of significant assistance in meeting the needs of an expanding and increasingly urbanized population. In the past few decades, the field of biotechnologies has advanced at a formidable speed and generated numerous innovations particularly in the field of pharmaceuticals and some in the field of agriculture. In the food and agriculture sector, it is helping to reduce losses from some pests and diseases and increasing environmental sustainability, especially in developed countries. There are new breakthroughs in genomics and bioinformatics that are expanding our understanding of nature and its diverse functions.

Honourable delegates, colleagues, ladies and gentlemen,

Despite these contributions from conventional technologies and biotechnologies, the number of underfed in the world is greater today than at any time in our history, standing at around one billion people. Approximately 75 percent of the world's hungry and poor live in rural areas and derive their livelihoods from agriculture. The current unacceptable level of food insecurity is worsened by the uncertainties of climate change, which hits harder the developing countries. At the same time, there is demand for improved variety, quality and safety of agricultural products, driven by urbanization and rising incomes.

[1] ftp://ftp.fao.org/docrep/fao/Meeting/018/k6050e.pdf

Our challenge is to increase food productivity, through scientific and sustainable practices and efficient resource use, while preserving the natural resource-base and environmental quality. These realities call for adoption of a strategic approach for sustainable production intensification: a framework that can provide an adequate supply of food of requisite quality with more efficient and resilient production systems using good farming practices that make efficient use of the natural resources, coupled with enabling policies and institutional framework. Intensification must also deliver benefits to farmer livelihoods and support especially the smallholders who are key to achieving food security.

Scientific and technical advances must underpin the sustainable intensification of production. A new approach to agricultural research and development is needed that supports the wider and wiser use of agricultural biodiversity to promote development and improve food security. New technologies should make their contributions also through efficiency gains from better management of inputs and biodiversity. This will require greater involvement of farmers, institutions and communities. It will require other enabling factors, such as policies, institutional support, and investment in human and physical capital and in-country capacity building. FAO focuses its activities on support to smallholders in order to sustainably increase agricultural production, improve access to markets and enhance livelihoods.

Biotechnologies should play a more direct and critical role with their contributions and innovations. When biotechnologies are developed and adopted, they should build upon existing conventional knowledge and technologies. At present, there is a lack of appropriate and useful technologies, policies, technical capacities, and requisite infrastructure for their development, evaluation and deployment in most developing countries. Most biotechnologies often cannot be fully exploited because they are not well integrated with the components of the production systems. Often, there is emphasis on genetically modified organisms only, which overshadows all other biotechnologies and their potential contribution to agriculture. In addition, the synergy between the public and private sector remains to be harnessed to achieve the desired goal. As a result, biotechnologies are not yet making a significant impact in the lives of people in most developing countries.

This Conference is about how to redirect biotechnologies in a way that they can benefit poor farmers in poor countries and not only rich farmers in rich countries. The international community should play a key role in supporting developing countries by fostering partnerships and providing a framework for international cooperation and funding for the generation, adaptation and adoption of appropriate biotechnologies. Such a process would involve the leveraging of the outputs, with the existing capacities in the national governments, the CGIAR centres and other partners committed to provision of public goods in order to

provide a direct access to biotechnologies for the developing world. FAO will continue to provide all assistance to strengthen national and regional capacities for making informed decisions with respect to use of biotechnologies.

Honourable delegates, colleagues, ladies and gentlemen,

The Millennium Development Goal to reduce hunger and extreme poverty by half cannot be met five years from now with a "business as usual" approach. Appropriate biotechnologies, if aimed at problems and needs of smallholders in developing counties and supported by the necessary investments in strengthening national technical and policy capacities, can contribute toward meeting that goal. The future for agriculture implies a complex set of challenges, but the battle against hunger must be won.

I wish you a very productive meeting, and look forward to the results of your deliberations. Thank you for your kind attention.

14.3 MARIANO RUIZ-FUNES MACEDO, SAGARPA, MEXICO

Muy buenos días a todos;
Sr. Secretario De Desarrollo Rural del Gobierno del Estado de Jalisco,
Sr. Álvaro García Chávez;
Representante personal del Director General de FAO, Sr. Modibo Traoré;
Honorables miembros del presídium;
Señoras y señores investigadores y conferencistas, funcionarios y amigos que nos acompañan, sean todos ustedes bienvenidos a México.

Es un honor para mí acompañarlos en la inauguración de esta Conferencia Técnica Internacional sobre Biotecnologías Agrícolas en los Países en Desarrollo, de gran relevancia para el sector agroalimentario mundial, y de particular interés del Secretario Francisco Mayorga, quien les envía un cordial saludo. Agradezco a la FAO haber elegido a México como anfitrión de este evento, lo que es particularmente significativo porque nuestro país fue pionero en la Revolución Verde, que generó un cambio de paradigma en las prácticas agrícolas de numerosas zonas del mundo, con el consecuente incremento de la producción de alimentos. Nuestro recuerdo y reconocimiento para el Dr. Norman Borlaug y al grupo de científicos mexicanos que la hicieron posible.

El reto para producir mas alimentos sigue presente; En congruencia con los objetivos de aumentar la productividad agrícola y la seguridad alimentaria, conservando los recursos naturales y la biodiversidad del planeta, establecidos por FAO, resulta relevante esta

Conferencia, que debe ser un ejercicio técnico de análisis sobre las experiencias, situación actual y perspectivas del uso de la biotecnología en el sector agroalimentario, a fin de coadyuvar a la alimentación de millones de personas en el mundo.

Los desafíos no son menores. De acuerdo Naciones Unidas, la población mundial alcanza 6 mil 800 millones de habitantes, más de 2.5 veces que en 1950, y se estima que alcanzará 9 mil millones en 2045, lo que se traducirá en una enorme demanda de alimentos. Ese reto es aún mayor si se toman en cuenta los efectos negativos del cambio climático en la producción agropecuaria, y el deterioro de los recursos naturales, como resultado de las actividades humanas. Por ello, las acciones deben orientarse a buscar la seguridad alimentaria mediante la producción de alimentos suficientes, inocuos, accesibles y de calidad, pero cuidando en todo momento los recursos naturales y el medio ambiente. Se requiere aumentar la disponibilidad de semillas, recuperar la fertilidad de los suelos, hacer un uso eficiente del agua y darle valor agregado a la producción primaria.

Esta Conferencia es una oportunidad para analizar la problemática técnica y científica de la producción de alimentos desde diversos puntos de vista. La pregunta relevante es ¿Cómo la biotecnología contribuirá a atender la demanda alimenticia en un contexto caracterizado por consumidores cada vez más exigentes, mejor informados y más preocupados, no sólo por el contenido mismo de los alimentos, sino por cómo se produjeron y comercializaron?

La biotecnología ha permitido el desarrollo de nuevas herramientas que, sumadas al mejoramiento convencional de cultivos y animales, pueden aplicarse con diversos fines, como el mejoramiento genético de variedades vegetales y poblaciones animales; el aumento de rendimientos; la caracterización y conservación de los recursos genéticos; y el diagnóstico y prevención de enfermedades. La gama de posibilidades que ofrece la biotecnología también debe responder a los cambios en los patrones de consumo, como los alimentos con propiedades nutraceúticas, con más vitaminas y minerales, y que resistan mejor el transporte y el almacenamiento. A la vez, debe propiciar que las actividades productivas sean más rentables, se produzcan en menores superficies y con un uso mas racional del agua. Esa es la relevancia y el potencial del tema que hoy nos ocupa.

En México, uno de los principales objetivos del Plan Nacional de Desarrollo, es “abastecer el mercado interno con alimentos de calidad, sanos y accesibles provenientes de nuestros mares y campos”, mediante el desarrollo, adaptación y adopción de nuevas tecnologías. Múltiples de los desafíos que enfrenta el sector agrícola en México son fundamentalmente técnicos, y deben ser abordados con esa orientación. De ahí la importancia de emprender un cambio que, por un lado, se base en la experiencia de nuestros agricultores en el manejo de técnicas tradicionales y reconozca nuestra riqueza y diversidad biológica y, por otro, aplique nuevas tecnologías, para incrementar la productividad. Actualmente,

México cuenta con capital humano e infraestructura para contribuir a los avances de la biotecnología y transformarla en un instrumento estratégico para su desarrollo. En las últimas tres décadas, en el país se ha generado una red de investigación en biotecnología, con más de mil investigadores de alto nivel y cerca de cien instalaciones con capacidades competitivas internacionalmente, en diferentes disciplinas. Asimismo, para fortalecer la formación de talentos, el país cuenta con universidades e institutos que ofrecen programas de postgrado en Biotecnología y Ciencias Agrícolas, que han abierto sus puertas a estudiantes e investigadores de otros países.

Por otra parte, el país tiene un elevado potencial de crecimiento industrial, en particular en las áreas relacionadas con recursos biológicos. Existen empresas mexicanas que han incursionado exitosamente en el desarrollo y fabricación de productos a partir de biotecnologías modernas. Ese es el caso de procesos para biofermentación y producción de bioenergéticos alternativos; biofertilizantes; y la mejora de las características agronómicas de cultivos de alta importancia económica, principalmente las relacionadas con la resistencia al estrés biótico.

De acuerdo con la estrategia establecida por el Presidente Felipe Calderón, en el sector agropecuario se trabaja en cuatro ámbitos: uso eficiente de agua, manejo de enfermedades y plagas, mantenimiento de la fertilidad del suelo y mejoramiento genético de variedades.

Como en la década de los sesenta, la biotecnología debe ser un instrumento para que los países en desarrollo, aprovechen su riqueza biológica e, insisto, con respeto al medio ambiente, a la diversidad y a la salud, a fin de impulsar la productividad del sector agropecuario, incrementar la oferta de alimentos y mejorar las condiciones de vida de millones de personas en todo el mundo.

Parte importante del desarrollo de esos países dependerá de su habilidad para adquirir, adoptar, desarrollar y difundir innovaciones de productos y procesos basados en la biotecnología, científicamente sustentada y adecuada al contexto de cada país. Esta Conferencia es una oportunidad para mirar hacia el futuro, conjuntar esfuerzos e identificar líneas de acción, que sirvan de marco para la cooperación internacional y el financiamiento de desarrollos biotecnológicos.

Por último, quiero hacer un reconocimiento a todos ustedes, investigadores destacados de varias partes del mundo. Gracias a su labor y compromiso, hoy vemos en la biotecnología una herramienta para avanzar en el propósito de poner alimentos disponibles y accesibles para los próximos años, mejorar las condiciones de vida de casi mil millones de personas, que padecen hambre y pobreza en muchas regiones del planeta.

Muchas gracias y les deseo el mayor de los éxitos.

14.4 M.S. SWAMINATHAN, HONORARY CHAIR OF ABDC-10 STEERING COMMITTEE

BIOTECHNOLOGY AND SHAPING THE FUTURE OF FOOD SECURITY

Demographic explosion, environment pollution, habitat destruction, enlarging ecological footprint, co-existence of widespread hunger and unsustainable life styles, and potential adverse changes in climate all threaten the future of human food, water, health and livelihood security systems. The year 2010 appears to mark the beginning of uncertain weather patterns and extreme climate behaviour. Events like temperature rise, drought, flood, coastal storms and rise in sea level are likely to present new challenges to the public, professionals and policy-makers. Biodiversity has so far served as the feedstock for sustainable food and health security and can play a similar role in the development of climate resilient farming and livelihood systems. Biodiversity is also the feedstock for the biotechnology industry. Unfortunately, genetic erosion and species extinction are now occurring at an accelerated pace due to habitat destruction, alien species invasion and spread of agricultural systems characterized by genetic homogeneity. Genetic homogeneity enhances genetic vulnerability to biotic and abiotic stresses. To generate widespread interest in biodiversity conservation, the UN General Assembly has declared 2010 as the International Year of Biodiversity.

Biodiversity: Feedstock for the biotechnology industry

The global Convention on Biodiversity (CBD) adopted at the UN Conference on Environment and Development held at Rio de Janeiro in 1992, and the International Treaty on Plant Genetic Resources for Food and Agriculture adopted by Member Nations of FAO in 2001 provide a road map for the conservation and sustainable and equitable use of biodiversity. CBD emphasizes that biodiversity occurring within a Nation is the sovereign property of its people. Hence, the primary responsibility for conserving biodiversity, using it sustainably and equitably and preserving it for posterity rests with each Nation. This implies that all Nations should subject development programmes to a Biodiversity Impact Analysis in order to ensure that economic advance is not linked to biodiversity loss. Inter-generational equity demands that we must preserve for posterity at least a representative sample of the biodiversity existing in our planet today.

Initiatives like the recognition of Globally Important Agricultural Heritage Systems of FAO and the World Heritage Sites of UNESCO are important to generate interest in the conservation and enrichment of unique biodiversity sites. Particular attention will have to be given to protecting the protected areas through public education and social mobilization,

in addition to appropriate regulation. Unfortunately, many of the protected areas, National Parks and Biosphere Reserves are facing serious anthropogenic pressures. Based on the model of the Biosphere Trust for the conservation of the Gulf of Mannar Biosphere Reserve in India developed by the M S Swaminathan Research Foundation (MSSRF), Biosphere Reserves could be jointly managed by local communities and Government departments. The concept of participatory forest management should be extended to national parks and biosphere reserves.

Special attention should be paid to biodiversity hotspots. Through public cooperation, they should be converted into biodiversity "happy spots", where the sustainable use of biodiversity helps to generate new jobs and income. Coastal biodiversity has not received adequate attention. Mangrove wetlands are under various degrees of degradation. The Joint Mangrove Forest Management procedure developed by MSSRF should be implemented wherever mangrove genetic resources still occur.

Biodiversity conservation and sustainable management should become a national ethic. Government agencies including local self-government authorities like Panchayats in India could play an important role in both spreading biodiversity literacy through Community Biodiversity Registers and by creating the necessary infrastructure like Gene and Seed Banks. Awareness of the relationship between biodiversity and human health and farm animal survival should become widespread.

Women play a lead role in biodiversity conservation and sustainable use. Mainstreaming of the gender dimension in all conservation and food security programmes is a must. Women conservers should be enabled to continue their conservation ethos, by providing support for essential infrastructure. Agro-biodiversity is the result of interaction between cultural diversity and biodiversity. An important aspect of cultural diversity is culinary diversity. Every step should be taken to recognize and preserve cultural diversity and to blend traditional wisdom with modern science.

Biodiversity is the feedstock not only for food and health security, but also for the management of climate change induced alterations in temperature, precipitation and sea level. Genebanks for a warming planet have become urgent for promoting climate resilient farming systems. We must preserve for posterity a sample of the existing genetic variability in all ecosystems. In this context, the initiative of the Government of Norway in establishing a Global Seed Vault under permafrost conditions at Svalbard near the North Pole is a significant milestone in humankind's battle against genetic erosion. The Defence Research and Development Organisation (DRDO) of India have also recently established under permafrost conditions at Chang La in the Himalayas a National Gene Bank. The prospects for climate change have added urgency to efforts designed to save every gene and species now existing in our Planet.

Good biosafety: Prerequisite for successful biotechnology enterprises

The role of farmers and farming in the mitigation of climate change has not so far been adequately recognized and appreciated. Farmers can help build soil carbon banks and at the same time improve soil fertility through fertilizer trees. Mangrove forests are very efficient in carbon sequestration. Biogas plants can help to convert methane emissions into energy for the household. Hence, a movement should be started at the global, national and local levels for enabling all farmers with small holdings and a few farm animals to develop a water harvesting pond, plant a few fertilizer trees and establish a biogas plant, in every farm. A farm pond, few fertilizer trees and a biogas plant will make every small farm contribute to climate change mitigation, soil health enhancement and water for a crop life saving irrigation.

As a scholar in Genetics at the Cambridge University during 1950–52, I have followed the growth of molecular genetics from the time Watson and Crick discovered the double helix structure of the DNA molecule. Molecular genetics has opened up uncommon opportunities for solving chronic problems in agriculture and medicine. While all aspects of biotechnology like micropropagation and food processing are important, the hard core of biotechnology is recombinant DNA technology. We are now able to transfer genes across sexual barriers with precision. Marker-assisted selection (MAS) has accelerated the pace of progress of plant breeding. Varieties developed by MAS are permitted for use in organic farming.

We have now entered an era of climate change leading to potential adverse changes in temperature, precipitation and sea level. We need new genes for meeting the challenges of a warming planet. The development of new strains possessing resistance to biotic and abiotic stresses like salinity and drought needs the help of genetic engineering.

While there are no serious conflicts, other than ethical, in the field of medical biotechnology, there are apprehensions of threats to human health and the environment in the case food biotechnology. Therefore, every country should have a National Biotechnology Regulatory Authority, which is autonomous, professionally led and which inspires public, political, professional and media confidence. "The bottom line of our national agricultural biotechnology policy should be the economic well-being of farm families, food security of the nation, health security of the consumer, biosecurity of agriculture and health, protection of the environment and the security of national and international trade in farm commodities".

I hope the Biotechnology Conference will provide a road map for maximizing the benefits of the new genetics and minimizing potential risks. Biotechnology can help to shape the future of sustainable food security.

14.5 RODNEY COOKE, IFAD

INVESTING IN AGRICULTURAL RESEARCH AND AGRICULTURAL BIOTECHNOLOGIES

14.5.1 The scale of these challenges and why we need to invest

The climate change negotiations of 2009 looked to political will to secure a future worth living for our children. A future in which there is food security for all. A future in which the challenge of climate change is acknowledged, addressed and overcome. Critical to achieving both of these goals is rural development.

The first Millennium Development Goal (MDG) that was adopted by the world leaders of the UN in 2000 was an undertaking to reduce the number of hungry people by half by 2015 from 850 million at that time, to around 400 million. A few years ago, little progress had been made and the food price crisis of 2007–08 actually led this figure to rise to over 1 billion people. Serageldin (2009) referred to this "silent holocaust, which causes some 40,000 hunger-related deaths every day".

In IFAD we believe the world community has learnt important lessons from the recent food price crisis:

First: The world can ill afford to under-invest in agriculture. While the food crisis of 2007/2008 was exacerbated by short-term developments – such as crop failures in major cereal producing countries – it was fundamentally a reflection of the failure of world supply to keep pace with growing demand, largely due to declining or stagnant agricultural productivity in developing countries after two decades of under-investment.

Second: In today's interconnected world, food crises will undoubtedly have an immediate and massive impact on the poor in developing countries. Recent estimates indicate that more than 100 million people joined the ranks of the hungry as a result of the food and global economic crises.

The world's population is projected to grow from 6.8 billion to 9.1 billion by 2050. Most of the growth is expected to take place in developing countries. Feeding 9.1 billion will require that overall global food production increases by 70 percent. Production in the developing countries would need to almost double. Over the past three decades, agricultural productivity in developing countries has been stagnant or in decline, as a consequence of under-investment in the sector. Developing countries' public spending on agriculture declined from 11 per cent of national budgets in the 1980s to seven per cent in recent years. Moreover, the share of official development assistance (ODA) allocated to agriculture dropped from about 20 per cent to four per cent.

While increased food production is necessary, it is not sufficient on its own to avert food crises. Food security requires distribution mechanisms that enable equal access to food for all

people. It is not enough to increase production and productivity; farmers should be linked to markets, not necessarily international markets but the last mile to vibrant and competitive local markets. Smallholder farmers need to increase their production to enhance national food security, but governments have to create the environment to enable them to do so. The crisis has shown that smallholder farmers often find it difficult to respond to sharp increases in demand and higher food prices in the absence of supporting institutions and appropriate infrastructure.

Climate change is expected to put some 49 million more people at risk of hunger by 2020 (IPCC, 2007). In Africa alone, where about 95 per cent of agriculture depends on rainfall, climate change is expected to cause severe water shortages that will affect between 75 million and 250 million people by 2020. In some countries, yields from rainfed agriculture could fall by 50 per cent by the same date. In other words, the people that will pay the price of climate change are the poor and vulnerable, and especially the three quarters of the world's poor living in rural areas and depending on agriculture. These people stand to be hit first and hardest.

However, agriculture is not just a victim, it is also in part a culprit creating climate change. Agriculture and deforestation together account for an estimated 26–35 per cent of greenhouse gas (GHG) emissions. Afforestation and reforestation, better land-management practices such as agro-forestry, rehabilitation of degraded crop and pasture land and better farming practices can all contribute significantly to reducing GHG emissions.

In other words, agriculture – as well as being part of the problem – can also be part of the solution to climate change and food security. Nevertheless, most of the key players are the poor and vulnerable: rural people in developing countries. There are 500 million smallholder farms worldwide supporting around two billion people, or one third of the world's population. They farm 80 per cent of the farmland in Asia and Africa. They produce 80 per cent of the food consumed in the developing world and they feed one third of the global population. Our focus should be on increasing smallholder productivity, and reducing their vulnerability.

Rural women in particular need to be able to fulfill their potential. Women are increasingly the farmers of the developing world, performing the vast majority of agricultural work and producing between 60 and 80 per cent of food crops. To boost smallholder productivity and production will require consistent and sustained investment in agriculture. Such investment can pay huge dividends: GDP growth generated by agriculture is at least twice as effective in reducing poverty than growth in other sectors (World Bank, 2007).

Two key challenges face humanity, namely our ability to meet the goal of food security for all while managing climate change. Both of these simultaneously constitute a tremendous challenge. Old failures in rural development and now these new challenges call for new solutions in approaching rural poverty reduction. This indicates the important role for research, but in effective innovation systems.

14.5.2 Innovation systems: Effective investments in agricultural research

Agricultural investment plans must be coherent with overall national plans for economic development and poverty reduction. They must distinguish between situations which are amenable to economic development through technical advances, and in cases where the lot of the poor can be better or must first be improved by other means, such as support for health, domestic water, education or infrastructure programmes. The planning process will be country-specific. An essential need in an agricultural research plan is that it provides for knowledge and information flow in two directions. A farmer-centric participatory approach requires that the products of strategic and applied research are moved from trained scientists to farmers in rural communities and that the demands and indigenous knowledge of the rural community should flow to the scientists. This is multi-disciplinary in its approach to constraint identification and alleviation and must widen stakeholder participation to engage the contributions of those concerned with the non-technical constraints to poverty reduction. These innovation systems intend to lead to sustainable production systems which include the following attributes (Royal Society, 2009):

- Utilizes crop varieties and livestock breeds with high productivity per externally derived input.
- Avoids the unnecessary use of external inputs.
- Harnesses agro-ecological processes such as nutrient cycling, biological nitrogen fixation, etc.
- Minimizes the use of practices that have adverse impacts on the environment and health.
- Makes productive use of human and social capital in the form of knowledge and capacity to adapt and innovate, and to resolve common landscape-scale problems.
- Minimizes the impacts on externalities such as GHG emissions, clean water availability, carbon sequestration and conservation of biodiversity.

It is essential that rural people are provided with the means to adapt to climate change. They need seeds that are more resistant to drought or to floods and they need cutting-edge agricultural technologies. This must be linked to rural financial services to allow them to invest in the future and to help tide them over in lean times.

14.5.3 What does this mean for agricultural biotechnologies?

Paper ABDC-10/8.1[2] reminds us that "Science, technology and innovation underpin every one of the MDGs. It is inconceivable that gains can be made in health and environmental concerns without a focused science, technology and innovation policy" (UN Millennium Project, 2005). Yet the almost total neglect of science and technology (S&T) in the Poverty

[2] See Chapter 8 of this book

Reduction Strategy Papers emphasizes again the need for more joined-up S&T management. Securing appropriate and consistent levels of funding for agricultural S&T has consistently been hugely problematic for most developing countries.

Options to increase the levels of funding and increase the impact of S&T (derived from ABDC-10/8.1[3]) include:

Increased funding

- redirecting part of the total public support package for agriculture to innovative technological packages;
- developing much closer partnerships with R&D supported by other ministries and their donors;
- encouraging commercialization of agricultural R&D;
- introducing commodity levies and tax check-offs to support "pro-poor" agricultural R&D.

Efficiency and targeting of funding

- moving progressively away from traditional arrangements for centrally-based national agricultural research organization;
- changing the criteria for priority-setting and procedures for allocating funds;
- linking research priorities more explicitly to wider social and economic needs;
- creating formal structures and mechanisms for stakeholder participation in R&D policy;
- giving increasing priority to research that is jointly formulated and implemented through public-private partnerships (PPPs);
- giving increased priority to research projects on local and regional product value chains and production systems;
- In general establishing S&T and innovation funding windows based on thematic "problem-based" priorities and "value chains";
- encouraging and enforcing intellectual property protection.

In the crops background paper[4] (ABDC-10/3.1), priority options for developing countries are brought together under eight headings. However, the sequence or flow of these headings should be perhaps recast as follows:

Policy development and priority-setting

Countries should develop expertise to ensure that they can make sovereign decisions about adopting biotechnologies and be able to carry out their own independent, broad-based risk/benefit analyses of implementing such technologies

[3] idem
[4] Chapter 1 in this book

Linkages between biotechnology and other agricultural R&D

Biotechnological research should be more effectively linked to strong and well-resourced agricultural R&D programmes.

Capacity development

Countries should develop biotechnology capacities of the National Agricultural Research Systems.

Regulation of biotechnology utilization

All countries should be encouraged to establish consistent and transparent, evidence-based decision-making processes to regulate crop biotechnology R&D, and its application.

Shared access to technologies

Effective and equitable mechanisms for PPP and South-South collaboration should be established, where appropriate.

Uptake of biotechnologies

Biotechnology development should be strongly linked with strategies for its widespread dissemination. Stronger extension services involving participatory crop improvement programmes should be an integral part of national/regional agricultural support structures, including enhanced seed production and distribution systems.

Documentation of development and impact

Developing countries should document and analyse the adoption and socio-economic impacts of crop biotechnological innovation to advise policy-makers on the cost/benefit implications of biotechnology application.

Investments in biotechnology R&D

Developing countries, possibly working in regional groups, should build up indigenous research, development, and advisory capacities for generation, assessment and adoption of appropriate biotechnologies.

In the livestock paper[5] for this conference (ABDC-10/5.1), the way forward notes that the application of such biotechnologies should be supported within the framework of a national livestock development programme. Secondly, that the targeted users of these biotechnologies are normally resource-poor farmers with limited purchasing power,

[5] Chapter 3 in this book

therefore appropriate models are needed to ensure that the eventual products are acceptable to them. Thirdly, if biotechnologies are to be adopted they should build upon existing conventional technologies.

14.5.4 Agricultural biotechnologies, sustainable agriculture and agricultural biodiversity

Professor Swaminathan, in his opening message[6] to ABDC-10, observed that Biodiversity has so far served as the feedstock for sustainable food and health security and can play a similar role in the development of climate resilient farming and livelihood systems.

The UN General Assembly has declared 2010 as the International Year of Biodiversity. Sustainable agriculture comes with the notion of financial and institutional viability but also ecological soundness and technological appropriateness. Farmers in climatically unreliable, low-external-input environments usually need to maintain more diversity by default: they plant more than one variety per crop, using traditional varieties that have been adapted to environmental variation and uncertainty as well as to local preferences and socio-economic settings through repeated reproduction and selection.

However, we must recognize that these traditional farm-based systems usually have fewer opportunities for genetic recombination and cross-breeding, and often perform poorly in the production of disease-free seed and in seed storage, which are some of the domains in which formal institutional seed systems appear to be far more effective.

This calls for the development of synergies between formal science and informal knowledge systems and requires the design of new, specific and locally adapted approaches to analyze genetic diversity and farmers' practices – the intellectual property embedded in these which drives the incentive structure of farming communities to sustain such diversity – and ultimately the sustainability of the agricultural production system. There is a need to identify the relevance and the dynamics of genetic variability conservation in the context of small-holders' coping strategies, enhance the use of diversified plant genetic resources for sustainable agriculture and sustained improvements in food production – towards better household food security. Recent studies indicate that too narrow a range of crops is leading to reduced honey bee populations in many countries – bees seem to require pollen from a diverse range of flowering plants if they are to develop strong immune systems that are essential to survival. This is an example of one of many "knock-on effects" of diminishing plant diversity in rural areas.

IPR and traditional knowledge and germplasm: The role of the CBD

The Convention on Biological Diversity (CBD) mandates that the contracting Party shall: "respect, preserve and maintain knowledge, innovations, and practices of indigenous

[6] See Part 14.4 of this Chapter

and local communities embodying traditional lifestyle relevant for the conservation and sustainable use of biological diversity".

Today, IFAD commits three-quarters of a billion dollars annually to loan and grant-financed projects to fight rural poverty. This is set to average around US$1 billion per year in the next three years. All Fund-financed projects and programmes impinge on agricultural production systems and have an impact on agricultural biodiversity. We have long recognized that the rural poor and the farming communities who our projects are designed to benefit, are in fact the custodians of a diverse gene pool and are the main purveyors of agricultural agro-biodiversity.

Through its focus on a pro-poor innovations agenda, IFAD supports the generation, development and diffusion of sustainable agricultural technologies. This means that we clearly recognize that technological change should not happen at the expense of the natural resource-base. IFAD's projects and programmes address around 30 million smallholder farmers every year – and a large majority of these eke out a survival in remote, marginalized agro-ecosystems where the conservation of their fragile agricultural biodiversity is critical to the sustainability of their livelihood systems. This requires application of significant local knowledge, skills, ingenuity and innovation to the biophysical resources at hand – and equally to the conservation and utilization of germplasm – local planting material that is adapted to the local conditions.

With financial support from IFAD, Bioversity International has investigated sustainable utilization of plant genetic resources in desert-prone areas of Mali and Zimbabwe. Through programmes of action research, scientists worked with farmers to develop innovative methods to identify, protect and utilize endangered traditional crops. These genetic resources were, are and hopefully will continue to be of significant importance to the food security of poor rural communities. Of particular importance was the testing of alternative models for community-based *in situ* seed conservation in conjunction with farmers benefiting from development projects financed by IFAD loans. Using participatory methods, appropriate sites rich in crop genetic diversity were identified, selected, and then mapped before drawing up procedures for the conservation of the genetic resources. Farmers were encouraged to build upon their own knowledge to enable them to identify and characterize traditional varieties and seed-systems. This work resulted in prototype models for *in situ* genebanks, on-farm seed production, storage and exchange between small farmers. Replication of successful models have not only led to better on-farm management of crop genetic resources but have promoted sustainable improvement of rural livelihoods through the forging of strategic partnerships between public and private sector entities, such as farmers organizations, government entities and seed companies. Another successful model led to the development of "Seed Diversity Fairs" which provide space for interaction

between farmers, development workers and researchers that leads in turn to decentralized approaches in research, training and curriculum development in plant breeding and seed systems. Crops involved in the programmes described included millet, sorghum, cowpea and Bambara groundnut – important crops in desert margin areas.

The impact of intellectual property rights on farmers' seed systems

Pro-poor intellectual property rights (IPR) systems build on the comparative advantage of these communities as custodians of the genetic resources, local know-how and innovation capacity. In order to foster creativity and innovation to promote sustainable agriculture, it is imperative to develop and deploy an appropriate system of IPR for fair and equitable sharing of benefits of new or original knowledge or capital embedded in germplasm – for instance, a landrace.

In general, very few investors in agriculture and rural development have adequately realized the role that agricultural biodiversity can play in addressing poverty and household food security in an eco-sustainable way. One way forward is the link between IPR, incentives and agricultural biodiversity-conservation-based sustainable production systems.

Farmers often receive commercial varieties as part of a package that includes credit, seed and agro-chemicals. In many cases, accepting such packages is the only way farmers can access credit in rural areas. The end result is a progressive marginalization or disappearance of local varieties. This follows the questionable idea of progress favouring the replacement by high yielding ("improved") varieties of traditional crop varieties in the most productive areas. In addition, farmers' seed systems are important to resource-poor farmers in poor agro-ecological environments because of the importance of locally adaptive varieties. In other words, intellectual property rights are working to reward standardization and homogeneity, when what should be rewarded is agro-biodiversity particularly in the face of climate change and the need to build resilience by encouraging farmers to rely on a diversity of crops. For this reason, Member States should promote innovation in both the commercial seed systems and the farmers' seed systems, ensuring that innovation in both works for the benefit of the rural poor.

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CHAPTER 15

ABDC-10 REPORT

15.1 INTRODUCTION

Participation at the ABDC-10 conference was by invitation and it brought together about 300 policy-makers, scientists and representatives of intergovernmental and international non-governmental organizations. This included delegations from 42 FAO member countries, namely Algeria, Argentina, Bhutan, Brazil, Cameroon, Canada, Cape Verde, the Cook Islands, Cuba, the Dominican Republic, Egypt, El Salvador, Gabon, the Gambia, Grenada, Guatemala, Haiti, India, Indonesia, Kenya, Lesotho, Malawi, Malaysia, Mexico, Morocco, the Netherlands, Nigeria, Pakistan, Panama, Peru, Qatar, Senegal, Sri Lanka, Suriname, United Republic of Tanzania, Thailand, Trinidad and Tobago, Turkey, United States of America, Uruguay, Zambia and Zimbabwe. On the afternoon of the final day, the member countries adopted the conference report, which is provided in this Chapter. Note, when references are made in the report to FAO background documents, keynote presentations or parallel session summary reports, the appropriate chapter in this book is now cited.

15.2 REPORT

I. OPENING OF THE CONFERENCE

1. The International Technical Conference on Agricultural Biotechnologies in Developing Countries: Options and Opportunities in Crops, Forestry, Livestock, Fisheries and Agro-industry to Face the Challenges of Food Insecurity and Climate Change (International Technical Conference), met in Guadalajara, Mexico, from 1 to 4 March 2010[1].

[1] The list of delegates and observers is available in Appendix D at www.fao.org/docrep/meeting/019/al295e.pdf

II. INTRODUCTORY REMARKS BY FAO AND THE GOVERNMENT OF MEXICO

2. Mr Alvaro García Chávez, Secretario de Desarrollo Rural del Gobierno del Estado de Jalisco (Mexico), welcomed delegates and observers to the beautiful city of Guadalajara, noting that the state of Jalisco is a leading agriculture producer. He stressed the importance of this timely global Conference indicating that agriculture needed improved technologies and tools to meet the challenges imposed by global food insecurity and poverty. Mr García Chávez stated that the tools and products of biotechnologies had to be used and produced in a responsible manner to achieve food security while ensuring biosafety and protection of the environment.

3. Mr Modibo Traoré, Assistant Director-General, Agriculture and Consumer Protection Department, of the Food and Agriculture Organization of the United Nations (FAO), welcomed delegates and observers[2]. On behalf of Dr Jacques Diouf, FAO Director-General, he thanked the Government of Mexico for hosting the event and FAO's partners in the initiative, including: the Mexican Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA), the International Fund for Agricultural Development (IFAD), the Consultative Group on International Agricultural Research (CGIAR), the Global Forum on Agricultural Research (GFAR), the International Centre for Genetic Engineering and Biotechnology (ICGEB) and the World Bank. The Conference has brought together policy makers, scientists, civil society and the private sector from FAO member states to take stock of the applications of biotechnologies across the different food and agricultural sectors in developing countries, to learn from the past successes and failures, and to chart a better course for the future. Mr Traoré stressed that the international community should play a key role in supporting developing countries by fostering partnerships and providing a framework for international cooperation and funding for the generation, adaptation and adoption of appropriate biotechnologies.

4. Mr Mariano Ruiz-Funes Macedo, Subsecretario de Agricultura, SAGARPA (Mexico) welcomed delegates and observers[3]. He expressed solidarity with Chile in light of the recent natural disaster and the challenges it was presenting for the country. Mr Ruiz-Funes Macedo noted that the growing human population is increasing the demand for food and other agriculture products and, at the same time, there is need to ensure maintenance of natural resources and the conservation of biodiversity. He indicated that Mexico is investing in developing skilled technicians and scientists in order to develop and effectively use biotechnologies, while recognizing the need to integrate modern and emerging technologies

[2] His statement is in Chapter 14.2 of this book
[3] His statement is in Chapter 14.3 of this book

with traditional knowledge and practices. Mr Ruiz-Funes Macedo expressed hope that the Conference would help to improve the availability of biotechnology tools for developing countries to support enhanced agriculture production while protecting the environment.

III. KEYNOTE ADDRESS

5. A representative of FAO read a keynote address on behalf of Mr M.S. Swaminathan, Chairman of the M.S. Swaminathan Research Foundation and Honorary Chair of the Conference Steering Committee[4]. He noted that biodiversity is the feedstock not only for food and health security, but also for the management of climate change, but unfortunately is rapidly being lost. Mr Swaminathan indicated the importance of the Convention on Biological Diversity and the International Treaty on Plant Genetic Resources for Food and Agriculture in addressing the conservation and the sustainable and equitable use of biodiversity, while observing that each nation is responsible for conserving its biodiversity. In his address, Mr Swaminathan stated that the fields of molecular genetics and genetic engineering have opened up opportunities to meet current global challenges. He also indicated that every country should have an independent National Biotechnology Regulatory Authority to ensure that policies provide for the well-being of farmers and consumers, protection of the environment and the security of trade in farm commodities. Mr Swaminathan hoped the Conference would provide a road map to help achieve sustainable food security.

IV. ELECTION OF THE CHAIRPERSON, VICE-CHAIRPERSONS AND RAPPORTEUR

6. Mr Jeffrey McNeely was elected as Chair. Ms Marilia Regini Nutti (Brazil) and Ms Priyanjalie K.M. Wijegoonawardane (Sri Lanka) were elected as Vice-Chairs. Mr Fernando Gómez Merino (Mexico) was elected as *Rapporteur*.

V. ADOPTION OF THE AGENDA

7. The Agenda was adopted as given in *Appendix A*.

VI. TARGETING BIOTECHNOLOGIES TO THE POOR

8. The FAO Secretariat presented Section A[5] of the background document, *Policy options for agricultural biotechnologies in developing countries,* which provided a framework for targeting biotechnologies to the poor, emphasizing the importance of placing biotechnologies

[4] His statement is in Chapter 14.4 of this book
[5] Chapter 7 of this book

in the context of wider policies for national agricultural and rural development and science and technology while also stressing the international dimensions of these policies and the importance of priority-setting.

9. The International Technical Conference thanked the Secretariat for the informative document. The Conference noted that the use and adoption of biotechnologies in developing countries is affected by a number of factors, such as the existence or absence of policy and regulatory frameworks for biotechnology, costs, farmer and public awareness of potential benefits of biotechnologies, consumer concerns for food safety and environmental protection, market conditions and product demand and capacity to access and use new biotechnologies. It noted that discussions regarding biotechnologies had often focused on genetically modified organisms, when there were many other biotechnology products in use by farmers, such as biofertilizers and biopecticides, as well as many tools and applications being employed within the agriculture sector.

10. The Conference stressed that diverse situations occur among and within countries as do issues, and that situation analysis of the current use and application of biotechnologies would greatly assist targeting of biotechnologies in developing countries. It also noted that sound biotechnology policies, regulations, management strategies, risk assessments, cost-benefit analysis and communication strategies would contribute to the further development and application of biotechnologies, and that national biotechnologies strategies should be prepared within the overall development strategy context of the country.

11. The Conference noted the need for participatory approaches in advancing consideration of the development and use of biotechnologies. Farmers, farmer organizations, producers, local communities and other stakeholders needed to be fully involved in the processes, and scientists needed to better understand farmer needs and production conditions in undertaking biotechnology research. The Conference stressed that the engagement of smallholder farmers and producers in developing countries was necessary to understand their particular challenges and needs, and to determine appropriate use of biotechnologies to assist small-scale farmers.

12. The Conference noted the importance of integrating modern biotechnologies with traditional knowledge and practices, and that new tools, policies and approaches should help farmers and producers to remain resilient and independent, and to continue their ecologically sustainable practices. It also noted that farmer willingness to adopt new tools and practices depended on their understanding of, and participation in, the resulting benefits,

such as increased production, productivity or, for example, increasing the shelf life of farm products. The Conference emphasized that the intent is for farmers and smallholders to benefit from biotechnologies.

13. The Conference agreed that the further development and application of biotechnologies in many developing countries would benefit from international and regional cooperation and technical and other assistance from international organizations. It noted the need for public research to continue to be supported in order to develop biotechnology tools, products and best sustainable practices, and that national and regional centres of excellence were potential mechanisms for collaboration, and to better focus biotechnology research on the needs of farmers.

VII. SUMMARIES OF PARALLEL SESSIONS OF DAY 1

14. The Conference received summary reports of the results of sector-specific roundtables on case studies of successful applications of biotechnologies in developing countries in crops, livestock, forestry, fisheries and aquaculture, and agro-industry. It also received summary reports of the results of parallel sessions on sector-specific background documents describing the current status and options from biotechnologies in developing countries[6].

VIII. INVESTING IN AGRICULTURAL RESEARCH AND AGRICULTURAL BIOTECHNOLOGIES

15. Mr Rodney Cooke, Director, Operational Policy and Technical Advisory Division, International Fund for Agricultural Development (IFAD), presented a paper on investing in agricultural research and agricultural biotechnologies[7]. He stressed that the world can ill afford to continue under-investing in agriculture given the levels of food insecurity and poverty and the need for effective adaptation strategies for agriculture in light of the challenges of climate change. Mr Cooke noted the need to focus attention on increasing productivity of smallholders and producers, including women farmers.

16. Mr Cooke stated that while investments in agriculture have proven to be highly effective in reducing poverty, securing consistent levels of funding for agricultural science and technology had been problematic for most developing countries, and this situation needed to be addressed. He stressed that agricultural investment plans must be coherent with overall national plans for economic development and poverty eradication. Mr Cooke called for

[6] Summary reports from the sessions are available in Chapter 11 of this book
[7] His paper is in Chapter 14.5 of this book

a farmer-centric participatory approach to agricultural research, whereby the products of strategic and applied research move from trained scientists to farmers in rural communities, and the demands and indigenous knowledge of rural communities flow to the scientists.

IX. ENABLING RESEARCH AND DEVELOPMENT IN AGRICULTURAL BIOTECHNOLOGIES

17. The Conference considered Section B[8] of the background document, *Policy options for agricultural biotechnologies in developing countries*, which dealt with public policies for fostering appropriate applications of agricultural biotechnologies, including: scientific and technical capacity building; approaches to, and mechanisms for, planning and funding; and requirements to ensure the safe use of agricultural biotechnologies through environmental and food/feed safety regulation. A number of delegates indicated that their countries had already established biotechnology policies and legal frameworks, which included biosafety.

18. The Conference stressed the need for capacity building to enable further development of biotechnology policy and legal frameworks in developing countries. Since many developing countries already have significant experience in developing and implementing biotechnology policies and legal frameworks, the Conference called for further collaboration among developing countries in particular, to share experiences and approaches. The Conference also requested that support be provided by FAO and other relevant international organizations in preparing biotechnology policy and legal frameworks, as requested.

19. The Conference noted that policy and legal frameworks could establish clear approval and monitoring procedures and the responsibilities and competencies for developing and using biotechnology, provide clarity and certainty for developers and users of biotechnology, as well as investors. The Conference noted that biotechnology is rapidly advancing and evolving, and biotechnology policies and regulatory frameworks would require ongoing review and updating to ensure they remain current and enabling.

20. The Conference stressed the need for communication strategies in the preparation and implementation of biotechnology policies and legal frameworks to promote involvement in the preparatory processes and awareness of regulatory and other requirements and responsibilities, and the benefits of biotechnologies.

21. The Conference emphasized the critical need for ongoing scientific training and education to advance biotechnologies in developing countries. Training to update scientists

[8] Chapter 8 of this book

through workshops, seminars, electronic conferences, science networks and exchanges, and other means would be beneficial. Establishing or enhancing linkages among research institutions and improving information exchange would also be effective means to build capacity, as would using or establishing centres of excellence and convening regional level training initiatives. The Conference noted that quick training responses would sometimes be required, for example, to respond to disease outbreaks affecting agriculture production and productivity.

22. The Conference also saw the need for long-term educational investments to develop the next generation of biotechnology scientists and agriculture extension workers. Incentives might be required to encourage young scientists to undertake research in developing countries to reduce the flow of scientists to developed countries.

23. The Conference indicated that biotechnology capacity building initiatives should take into account existing expertise and facilities, and strategically target country needs and challenges. Delegates indicated several areas for capacity building, including: to enhance legal expertise to prepare, administer and enforce biotechnology laws and regulations; to build capacity in risk assessment and risk management; to better respond to disease outbreaks affecting agriculture production; to advance sustainable agriculture and meet the needs of smallholder farmers and producers; to better utilize endemic species and develop aquaculture resources; and to enhance support for genebanks to assist in conserving genetic diversity as a basic resource for further development of biotechnologies.

24. Taking into consideration a proposal from a representative from civil society, the concern was expressed that genetically modified organisms should not be imposed on farmers in developing countries, in particular if these genetically modified organisms could adversely impact the livelihoods of smallholder farmers.

X. SUMMARIES OF PARALLEL SESSIONS OF DAY 2

25. The Conference received summary reports on the results of parallel sessions on the following cross-cutting issues: Development of genomic resources: Current status and future prospects; Genomic applications: Molecular breeding in developing countries; Enhancing human capacities: Training and education; Ensuring equitable access to technology, including gender issues; Empowering public participation in informed decision-making; Prioritising the role of the farmer; and Public-private partnerships[9].

[9] Summary reports from the sessions are available in Chapter 12 of this book

XI. BIOTECHNOLOGIES IN INTERNATIONAL AGRICULTURAL RESEARCH CENTERS

26. Mr Thomas Lumpkin, Director General, International Maize and Wheat Improvement Center, of the Consultative Group on International Agricultural Research (CGIAR), began his presentation by noting the important contributions of the late Norman Borlaug in the Green Revolution and in establishing global agriculture research networks. He provided a brief overview of biotechnology application in CGIAR research, stressing that much more investments in agriculture research and technology are required if we are to meet the challenge of feeding a growing human population, with less land and water, and reduced impacts to the environment.

27. Mr Lumpkin stated that a range of biotechnologies were already in use helping to conserve and characterize genetic resources, enhance agriculture production and productivity, produce vaccines and improve food safety, as examples. He also noted that the further development and use of biotechnologies would need to address a number of issues, such as the use of genetically modified organisms in developing countries, cost effectiveness, and establishing public-private partnerships. Given the potential benefits to agriculture, Mr Lumpkin noted that we must work to address challenges and concerns.

XII. ENSURING ACCESS TO THE BENEFITS OF RESEARCH AND DEVELOPMENT

28. The Conference considered Section C[10] of the background document, *Policy options for agricultural biotechnologies in developing countries,* which dealt with ensuring access to the benefits of biotechnology, and covered the issues of intellectual property rights, public awareness and participation and the roles of extension services. The Conference reiterated the need for effective communication with all stakeholders in advancing the development and use of biotechnologies. Dialogue was essential in order to avoid one-way communication, and various means of communication would need to be employed to reach out to rural people.

29. However, a number of delegates noted that while they had in place biotechnology policies and regulatory frameworks, which include biosafety, ensuring the participation of smallholder farmers and producers in decision-making processes is often difficult, and that empowering local people and identifying community leaders will promote and support effective participation. Lack of access to modern communication means, such as the Internet, and lack of education were cited as challenges to effective involvement in decision-making processes. Lack of resources is also a key impairment to the participation of poor farmers and producers.

[10] Chapter 9 of this book

30. Some delegates indicated success in communicating awareness of opportunities to utilize biotechnologies with their stakeholders. Examples included providing farmers with hands-on experience with biotechnologies, and having them transfer knowledge to other farmers. Extension services in some countries had also proved effective, as had farmer and producer training courses. Stakeholder forums were used to bring together scientists and producers on a regular basis to discuss opportunities and concerns in some countries. The important role of the CGIAR in building capacity in biotechnology was acknowledged, and further assistance from the Centers was requested.

XIII. TECHNOLOGY TRANSFER ASPECTS OF THE MULTILATERAL SYSTEM OF THE INTERNATIONAL TREATY ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE; SOUTH-SOUTH COLLABORATION

31. Mr Shakeel Bhatti, Secretary of the International Treaty on Plant Genetic Resources for Food and Agriculture, presented an overview of the International Treaty, which entered into force in 2004. He described the scope of the International Treaty and progress made in its implementation, including the use of a Standard Material Transfer Agreement that is being widely used. Mr Bhatti also reported on technology transfer under the Multilateral System of the International Treaty, and other accomplishments to date. Transfer of germplasm within the system is growing and operational procedures are well established, and a number of local level plant genetic resources projects are being supported through the Funding Strategy of the Treaty.

32. Mr Bhatti noted that the International Treaty provides for the transfer of technologies and associated human capacity building. He stated that implementation of the Treaty would contribute to efforts to adapt to climate change by enhancing the conservation of plant genetic resources, facilitating transfer of technology and by providing funding to developing countries. Mr Bhatti outlined some of the needs to further advance the operation of the International Treaty.

XIV. SUMMARIES OF PARALLEL SESSIONS OF DAY 3

33. The Conference received summary reports on the results of parallel sessions on specific regions: Latin America and the Caribbean; Near East and North Africa; Sub-Saharan Africa; Asia and the Pacific; and Eastern Europe and Central Asia. A number of issue papers were considered in these sessions. Summary reports were also received from parallel sessions dedicated to the following cross-cutting issues: Utilization of plants for non-food use: Challenges

and perspectives; Policy coherence at the regional level; Biosafety in the broader context of biosecurity; Intellectual property rights in agricultural biotechnology; and Conservation and sustainable use of genetic resources for food and agriculture[11].

XV. MOVING BEYOND BUSINESS-AS-USUAL: OPTIONS FOR DEVELOPING COUNTRIES; MOVING BEYOND BUSINESS-AS-USUAL: PRIORITIES FOR ACTION FOR THE INTERNATIONAL COMMUNITY

34. The Conference considered the background document, *Agricultural biotechnologies for food security and sustainable development: Options for developing countries and Priorities for Action by the international community*[12]. The Secretariat introduced the document, noting that the conclusions of the Conference would greatly assist in advancing discussions on agricultural biotechnologies within the governing bodies of FAO. The Chair of the Conference had prepared Chair's Text with key conclusions from the Conference to facilitate discussion on options for developing countries as well as priorities for action for the international community.

35. The Conference requested that consideration be given to starting a discussion on the establishment of an international agreement on sharing and using animal genetic resources for food and agriculture.

36. The Conference re-emphasized one of the conclusions of the UN Millennium Project, i.e. that science, technology and innovation underpin every one of the Millennium Development Goals.

KEY CONCLUSIONS

37. The International Technical Conference acknowledged that:
    a. Agricultural biotechnologies[13] encompass a wide-range of tools and methodologies that are being applied to an increasing extent in crops, livestock, forestry, fisheries and aquaculture, and agro-industries, to help alleviate hunger and poverty, assist in adaptation to climate change and maintain the natural resource base, in both developing and developed countries.

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[11] Summary reports from the cross-cutting and regional sessions are available in Chapters 12 and 13 respectively of this book

[12] Chapter 10 of this book

[13] The definition is broad and is based on that in Article 2 of the Convention on Biological Diversity, which states that biotechnology is "any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use". The specific kinds of biotechnologies encompassed by the term 'agricultural biotechnologies' are described in the sector-specific documents – Chapters 1 to 5.

b. The various applications of agricultural biotechnologies have not been widely used in many developing countries, and have not sufficiently benefited smallholder farmers and producers and consumers.
c. More research and development of agricultural biotechnologies should be focused on the needs of smallholder farmers and producers.
d. Governments need to develop their own national vision and policy for the role of biotechnologies, with options and opportunities examined within the context of national economic, social and rural sustainable development and environmental strategies, objectives and programmes.
e. Effective communication and participation strategies are necessary to encourage and promote public involvement and empowerment in decision-making processes, regarding the development and use of biotechnologies.
f. Stronger partnerships among and within countries will facilitate the development and use of biotechnologies, including south-south and regional alliances; incorporation of traditional knowledge; and public-private and research partnerships for sharing experiences, information and technologies.

38. The International Technical Conference agreed that:
a. Developing countries should significantly increase sustained investments in capacity building and development and safe use of biotechnologies; integrated with other agricultural technologies, including traditional knowledge, and maintain the natural resource base to support in particular, smallholders, producers and small biotechnology based enterprises; employing effective participatory approaches for the robust input from stakeholders in decision-making processes.
b. FAO and other relevant international organizations and donors should significantly increase their efforts to support the strengthening of national capacities in the development and appropriate use of pro-poor agricultural biotechnologies, and that they be directed to the needs of smallholders, consumers, producers and small biotechnology based enterprises in developing countries.
c. Both the lack of policies and regulatory mechanisms as well as overly stringent regulations hinder development of, and access to biotechnologies. Effective and enabling national biotechnology policies and science-based regulatory frameworks can facilitate the development and appropriate use of biotechnologies in developing countries; and ongoing reviews, improvement and harmonization of existing biotechnology policies and regulatory frameworks can keep them current and rational.

XVI. CLOSING REMARKS

39. Mr Modibo Traoré, FAO Assistant Director-General, Agriculture and Consumer Protection Department, began his statement by thanking the Government of Mexico and the State of Jalisco for hosting the Conference and for their generous hospitality. He expressed his appreciation to the organizations that had worked in partnership with FAO to organize and convene the Conference, which had brought together about 300 individuals from 68 different countries. Mr Traoré thanked all of the staff that had worked before and during the Conference to ensure the smooth running of the Conference. He noted that the Knowledge Share Fair had significantly contributed to the Conference, and thanked the 22 organizations that had participated in the Fair.

40. Mr Traoré thanked the delegates and observers for their advice and constructive inputs during the Conference, which resulted in clear and practical conclusions. He noted that the Conference had confirmed that the use of biotechnologies in the crop, livestock, forestry, fishery and agro-industry sectors can contribute to alleviating hunger and poverty and in promoting rural development in developing countries. Mr Traoré observed that the Conference had also underlined that countries are committed to assisting poor smallholders, fishers and forest-dependent populations in developing countries by ensuring that they have access to appropriate biotechnologies that focus on their problems and that they are fully involved in the decision-making processes regarding their development and use.

41. Mr Victor M. Villalobos, Director General, Inter-American Institute for Cooperation on Agriculture, noted that achieving and maintaining food security, in light of a growing human population and climate change, imposed numerous challenges for agriculture. He stated that demand for crops as fuels and other non-food uses and rising prices, also are affecting food security in developing countries, especially for poor rural people.

42. Mr Villalobos stressed that much of agriculture production was not currently sustainable and that this situation must change. Employing sound biotechnologies, he stated, could assist in addressing the global challenges of feeding a growing human population with less inputs and less adverse impacts on the environment. He reminded the Conference that we had faced many other challenges in our past, and now needed to work together to resolve current issues.

43. Mr Villalobos observed that the debate on genetically modified organisms had become polarized. He stated that we cannot afford to abandon the use of genetically modified organisms in agriculture, but that we must use them in a sound manner to assist in achieving our sustainability goals, and without adverse impacts on the environment. To achieve this, he stressed that science-based decision making and convergence of all actors on achieving food security and sustainable agriculture would be key. Mr Villalobos indicated that the Conference had provided valuable advice for the development and use of biotechnologies in developing countries, and that all countries now needed to carefully consider this advice in moving forward.

XVII. CLOSURE OF THE CONFERENCE

44. Mr Salvador Fernández Rivera, Coordinador de Investigación, Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP), on behalf of Mr Mariano Ruiz-Funes Macedo, Subsecretario de Agricultura, SAGARPA, thanked FAO and the other partners for organizing this important Conference in Mexico. He noted that many developing countries have common problems, and that the Conference had indicated the willingness of countries and experts to work together to resolve problems and meet the common global goals of achieving food security, without degrading the natural environment, and to address climate change. Mr Fernàndez Rivera expressed his satisfaction with the conclusions of the Conference, noted that the work is not yet finalized and hoped that in each country mechanisms could be developed to follow up on the conclusions. He emphasized that each country has to take its own decisions regarding use of agricultural biotechnologies and declared the Conference closed.

APPENDIX A

AGENDA

I. OPENING AND ORGANIZATIONAL MATTERS

1. Opening of the conference
2. Election of the Chairperson and Vice-Chairpersons
3. Adoption of the Agenda and Timetable
4. Appointment of the Rapporteur
5. Introductory remarks by FAO and the Government of Mexico
6. Keynote address

II. PLENARY SESSION 1

7. Targeting biotechnologies to the poor

III. PARALLEL ROUNDTABLES

Presentation and discussion of sector-specific case studies of successful applications of biotechnologies in developing countries

a. Crops
b. Livestock
c. Forestry
d. Fisheries and aquaculture
e. Agro-industry

IV. PARALLEL SESSIONS

Presentation and discussion of sector-specific background documents on the current status and options from biotechnologies in developing countries

a. Crops
b. Livestock
c. Forestry
d. Fisheries and aquaculture
e. Agro-industry

V. PLENARY SESSION 2

8. Summary - output of Day 1
9. Investing in agricultural research and agricultural biotechnologies
10. Enabling research and development in agricultural biotechnologies

VI. PARALLEL SESSIONS

Cross-cutting issues

a. Genomic applications (in collaboration with the CGIAR)
b. Enhancing human capacities: Training and education (in collaboration with the ICGEB)
c. Ensuring equitable access to technology, including gender issues (in collaboration with Oxfam International)
d. Empowering public participation in informed decision-making (in collaboration with the International Union for Conservation of Nature [IUCN])
e. Prioritising the role of the farmer; Public-private partnerships (in collaboration with the International Federation of Agricultural Producers [IFAP])

VII. PLENARY SESSION 3

11. Summary - output of Day 2
12. Biotechnologies in international agricultural research centers (CGIAR presentation)
13. Ensuring access to the benefits of research and development
14. Technology transfer aspects of the Multilateral System of the International Treaty on Plant Genetic Resources for Food and Agriculture
15. South-South collaboration

VIII. PARALLEL SESSIONS

Region-specific discussions

a. Latin America and the Caribbean (in collaboration with the Inter-American Institute for Cooperation on Agriculture [IICA] and the Technical Cooperation Network on Plant Biotechnology in Latin America and the Caribbean [REDBIO])
b. Near East and North Africa (in collaboration with the Association of Agricultural Research Institutions in the Near East and North Africa [AARINENA])
c. Sub-Saharan Africa (in collaboration with the Forum for Agricultural Research in Africa [FARA])
d. Asia and the Pacific (in collaboration with the Asia-Pacific Association of Agricultural Research Institutions [APAARI])
e. Eastern Europe and Central Asia

IX. PARALLEL SESSIONS

Cross-cutting issues

a. Policy coherence at the regional level (in collaboration with the United Nations Conference on Trade and Development [UNCTAD])
b. Biosafety in the broader context of biosecurity
c. Intellectual property rights (in collaboration with the World Intellectual Property Organization [WIPO])
d. Utilisation of plants for non-food uses: Challenges and perspectives (in collaboration with the United Nations Industrial Development Organization [UNIDO])
e. Conservation and sustainable use of genetic resources for food and agriculture (in collaboration with the CGIAR)

X. PLENARY SESSION 4

16. Summary - output of Day 3
17. Moving beyond business-as-usual: Options for developing countries
18. Moving beyond business-as-usual: Priorities for Action for the international community
19. Adoption of the conference Report
20. Closing remarks
21. Closure of the conference

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This book represents the proceedings of the FAO international technical conference dedicated to Agricultural Biotechnologies in Developing Countries (ABDC-10) that took place in Guadalajara, Mexico on 1-4 March 2010. A major objective of the conference was to take stock of the application of biotechnologies across the different food and agricultural sectors in developing countries, in order to learn from the past and to identify options for the future to face the challenges of food insecurity, climate change and natural resource degradation.

The proceedings are organized in two main sections. **The first section** contains ten chapters with an extensive series of FAO background documents prepared before ABDC-10. They focus on the current status and options for biotechnologies in developing countries in crops, livestock, forestry, fisheries/aquaculture and food processing/safety, as well as on related policy issues and options, in particular about targeting agricultural biotechnologies to the poor; enabling research and development (R&D) for agricultural biotechnologies; and ensuring access to the benefits of R&D.

The second section contains five chapters dedicated to the outcomes of ABDC-10, namely the reports from 27 parallel sessions of sectoral, cross-sectoral and regional interest, most of which were organized by different intergovernmental and non-governmental organizations and regional fora; keynote presentations; and the conference report adopted by delegates in Guadalajara on the final day.

SAGARPA
SECRETARÍA DE AGRICULTURA, GANADERÍA, DESARROLLO RURAL, PESCA Y ALIMENTACIÓN

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