BIOTECHNOLOGIES FOR AGRICULTURAL DEVELOPMENT

PROCEEDINGS OF THE FAO 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" (ABDC-10)

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS - 2011

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FOREWORD

Latest FAO figures indicate that the number of undernourished people in the world remains very high at close to one billion in 2010. The fact that one in six people in developing countries currently suffers from chronic hunger is not acceptable. Food security at local, regional and global levels will need to be realized in the face of emerging challenges.

The first is the rapidly changing socio-economic environment. It is estimated that the world's population will increase from about 7 to 9 billion people by 2050; that the proportion living in urban areas will increase from about 50 to 70 percent by 2050; and that people's diets will change, shifting to increased proportions of vegetables, fruits and livestock products. **The second** is climate change, which is expected to have an increasing impact on agriculture and food security.

Promoting sustainable agriculture in developing countries is key to achieving food security, and here it is necessary to increase investment in agriculture; broaden access to food; improve governance of global agricultural trade; and increase productivity while conserving the natural resource base. For the latter, it will be necessary to substantially increase investments in public agricultural research and development. Technologies to increase productivity and conserve natural resources should be accessible, appropriate and adapted to the needs of smallholders, and functional demand-driven extension systems are essential for making this happen. The suite of technological options for farmers should be as broad as possible, including agricultural biotechnologies, which represent a large range of technologies used in food and agriculture for the genetic improvement of plant varieties and animal populations, characterization and conservation of genetic resources, diagnosis of plant and animal diseases, vaccine development and other purposes.

To highlight the potential role of agricultural biotechnologies, FAO, in close collaboration with partners around the globe, organized 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" (ABDC-10) that took place in Guadalajara, Mexico, from 1 to 4 March 2010. The conference was hosted by the Government of Mexico and co-sponsored by 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 were also major collaborators in this initiative. The conference brought together about 300 policy-makers, scientists and representatives of intergovernmental and international non-governmental organizations, including delegations from 42 FAO Member Nations.

This publication represents the ABDC-10 proceedings. It contains an extensive series of background documents prepared for the conference, focusing on the current status and options for biotechnologies in developing countries in crops, forestry, livestock, fisheries/aquaculture and food processing/safety, as well as on related policy issues and options, in particular regarding targeting agricultural biotechnologies to the poor; enabling R&D for agricultural biotechnologies; and ensuring access to the benefits of R&D.

Member Nations reached at the ABDC-10 a number of key conclusions. They acknowledged that agricultural biotechnologies help to alleviate hunger and poverty, assist in adaptation to climate change and maintain the natural resource base; that agricultural biotechnologies have not been widely used in many developing countries, and have not sufficiently benefited smallholder farmers and producers and consumers; and that more R&D of agricultural biotechnologies should be focused on the needs of smallholder farmers and producers. They also acknowledged that governments need to develop their own national vision and policy for the role of biotechnologies; that effective communication and participation strategies with the public are necessary; and that stronger partnerships among and within countries will facilitate the development and use of biotechnologies.

The Member Nations also agreed that effective and enabling national biotechnology policies and regulatory frameworks can facilitate the development and appropriate use of biotechnologies in developing countries and that developing countries should significantly increase investments in capacity-building and the development and safe use of biotechnologies to support, in particular, smallholders, producers and small biotechnology-based enterprises. Finally, the countries agreed that 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.

International conferences such as ABDC-10 offer an essential neutral forum for FAO Member countries to meet, to access high-quality, updated science-based information and to discuss policy options on major food and agriculture issues.

We hope that the organization of ABDC-10 and publication of these proceedings will contribute substantially to empowering developing countries to make informed decisions about the application of agricultural biotechnologies to face the key challenge of food insecurity.

Jacques Diouf
FAO Director-General

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ACKNOWLEDGMENTS

The planning and build-up to the conference as well as the actual four-day event in Guadalajara were all hallmarked by a highly participatory approach, and it is not possible here to do justice to all the contributions of time, energy and expertise made by so many organizations and individuals to the processes of preparing for and convening ABDC-10; to writing and reviewing the background documents; and to creating the rich presentations and discussions that took place during the parallel and plenary sessions held during ABDC-10. FAO would like to take this opportunity to express its sincere appreciation for the kind and sustained cooperation of all concerned.

The conference brought together about 300 policy-makers, scientists and representatives of inter-governmental organizations (IGOs) and international non-governmental organizations (NGOs) from 68 countries, including governmental delegations from 42 FAO member countries. Special acknowledgements go to the Government of Mexico which generously hosted the conference and provided excellent logistical and personnel support. The national organizing committee met several times in the run up to the conference and its members, and their representatives, are gratefully acknowledged for their invaluable support: the Colegio de Postgraduados, Comisión Intersecretarial de Bioseguridad y Organismo Genéticamente Modificados (CIBIOGEM), Consejo Nacional de Ciencia y Tecnología (CONACYT), FAO Office in Mexico, Gobierno del Estado de Jalisco, Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (INIFAP), Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (SAGARPA), Secretaria de Relaciones Exteriores (SRE) and Sistema Nacional de Investigación y Transferencia de Tecnología para el Desarrollo Rural (SNITT). The national committee was kindly chaired by Víctor M. Villalobos, the Coordinator of International Relations at SAGARPA, and later the Officer in Charge, Lourdes Cruz Trinidad, with the support of Elías Reyes Bravo.

Grateful appreciation is also expressed to the staff at the FAO Office in Mexico for all their work before and during the conference, especially to the former FAO Representative Norman Bellino, the Assistant Representative Maria del Carmen Culebro, the communications officer Barbara Lazcano and programme officer Alicia Ituarte.

Special thanks also go to the International Fund for Agricultural Development (IFAD) which co-sponsored the conference; and to 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 who were major partners in the initiative.

We would also like to thank all the members of the international Steering Committee (SC), established to act as an advisory board as well as to guide and oversee the process leading up to the conference. These included individuals invited in their personal capacity because of their expertise in one or more areas of agricultural biotechnologies, as well as representatives of relevant stakeholder groups, including UN and non-UN intergovernmental organizations, civil society organizations, private foundations and private sector organizations. M.S. Swaminathan, from the M S Swaminathan Research Foundation in India, is also thanked for kindly accepting to serve as the Honorary Chair of the SC.

The contributions of all the FAO colleagues who made organization of such an international conference possible are gratefully acknowledged, including those who assisted with the ABDC-10 website, webstreaming of the conference, media issues and press releases, translation of conference documents, sending out official invitations to FAO Member States, IGOs and international NGOs and with numerous other tasks. Central to the whole process was the FAO Interdepartmental Working Group on Biotechnology (IDWGB) whose members provided the overall technical expertise and logistical advice and support necessary for the organization of this cross-sectoral initiative. Special appreciation is expressed to its Chair, Shivaji Pandey, for his tireless support and total dedication to the initiative. The former Chair of the IDWGB, James Dargie, is also especially thanked for his many contributions to the conference and these proceedings.

The commitment and hard work of the ABDC-10 Secretariat are also gratefully acknowledged. The Secretariat consisted of Andrea Sonnino (IDWGB Secretary) who, *inter alia*, coordinated preparation of these proceedings and John Ruane and Preetmoninder Lidder, who, in addition to other tasks, commented on numerous drafts of all the FAO background documents. The Secretariat also consisted of Germana Borsetta, Charlotte Lietaer, Adriana Pierconti and Sandra Tardioli, whose assistance with the innumerable logistical issues regarding the conference and travel was invaluable.

The convening of ABDC-10 would also not have been possible without the generous supplementary financial support provided by a number of organizations, whose contributions are gratefully acknowledged. The majority of the funding came from FAO and IFAD. The remainder came from the United States Mission to the UN Agencies in Rome, the Government of Mexico, GFAR, the Iowa State University Biosafety Institute and the Japan International Cooperation Agency. The ICGEB, International Union for Conservation of Nature (IUCN), United Nations Industrial development Organization (UNIDO) and World Intellectual Property Organization (WIPO) also funded participation of all the panellists for the parallel sessions that they organized and a number of other organizations funded participation of some of the panellists for their parallel sessions.

These proceedings were edited by James Dargie (former Chair of the IDWGB) and John Ruane, IDWGB. Contributions to the individual Chapters are now acknowledged.

Seven technical documents were prepared under the responsibility of FAO for presentation at ABDC-10. Five were sector-specific and are provided here in Chapters 1-5. One dealt with policy options for agricultural biotechnologies and was organized in three main Sections. For these proceedings, the Sections are presented in Chapters 7-9. The seventh document, which builds upon and integrates/synthesizes information from these six documents, is provided in Chapter 10.

For each of the FAO documents, there was an FAO focal point, a lead consultant and a working group (consisting of volunteers from the SC) to which the documents were circulated for comments. The seventh document was circulated to the entire SC for comments. The FAO focal point was responsible, with assistance from the lead consultant and the ABDC-10 Secretariat, for circulating the document to the working group and members of the IDWGB and, after receiving their comments, for finalizing the document. Here we gratefully acknowledge the contributors to these Chapters.

For the Chapter on crops (nr. 1), the FAO Focal Point was Andrea Sonnino (ABDC-10 Secretariat) and the lead consultant was Denis Murphy (University of Glamorgan, United Kingdom). Comments from the following SC members are gratefully acknowledged: Denise Dewar (CropLife International, United States); Dominic Glover (Wageningen University, the Netherlands); Kathleen Jones (Food and Drug Administration, United States); Pat Mooney (ETC Group, Canada); Olivier Sanvido (Agroscope Reckenholz Tänikon Research Station, Switzerland); and Roberto Tuberosa (University of Bologna, Italy). Comments from the following FAO colleagues are gratefully acknowledged: Karin Nichterlein and John Preissing (both from the Office of Knowledge Exchange, Research and Extension); Kakoli Ghosh, Elcio Guimarães, Philippe Le Coente, Annie Monard, Tom Osborn and Shivaji Pandey (all from the Plant Production and Protection Division); and Erik Busch-Petersen, Qu Liang, Chikelu Mba and Minh-Long Nguyen (all from the Joint FAO/IAEA Division, Austria).

For the Chapter on forestry (nr. 2), the FAO Focal Point was Oudara Souvannavong (Forest Conservation Service) and the lead consultants were Daniel Baskaran Krishnapillay (Pulau Banding Foundation, Malaysia) and Claire Williams (Silver Springs LLC, United States). Comments from the following SC members are gratefully acknowledged: Rowland Burdon (New Zealand Forest Research Institute Ltd, New Zealand) and E.M. Muralidharan (Kerala Forest Research Institute, India). Comments from the following FAO colleagues are gratefully acknowledged: Zohra Bennadji (visiting scientist from the Instituto Nacional de Investigación Agrupecuaria, Uruguay), Nuria Alba Montfort (visiting scientist from the Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria, Spain) and J.A. Prado (Forest Management Division).

For the Chapter on livestock (nr. 3), the FAO Focal Point was Paul Boettcher (Animal Production and Health Division) and the lead consultant was Harinder Makkar (University of Hohenheim, Germany). Comments from the following SC members are gratefully acknowledged: James Dargie (former Chair of the IDWGB), Elisabeth Erlacher-Vindel (World Organisation for Animal Health, France), Kathleen Jones (Food and Drug Administration, United States), Arthur da Silva Mariante (Brazilian Agricultural Research Corporation, Brazil) and Catherine Monagle (United Nations University Institute of Advanced Studies, Japan). Comments from the following FAO colleagues are gratefully acknowledged: Samuel Jutzi and Irene Hoffmann (both from the Animal Production and Health Division) and Adama Diallo, Mario Garcia-Podesta, Kathrin Schaten, Hermann Unger and Gerrit Viljoen (all from the Joint FAO/IAEA Division, Austria). Appreciation is expressed to the following people who contributed to the case studies in the Chapter: P.S. Brar and A.S. Nanda (Guru Angad Dev Veterinary and Animal Sciences University, India), John Crowther (Joint FAO/IAEA Division, Austria), José Fernando Garcia (São Paulo State University, Brazil), Mohammed Shamsuddin (Bangladesh Agricultural University, Bangladesh) and Chanda Nimbkar (Nimbkar Agricultural Research Institute, India).

For the Chapter on aquaculture and fisheries (nr. 4), the FAO Focal Points were Rohana Subasinghe and Doris Soto (both from the Fisheries and Aquaculture Management Division). Lead consultant was Victor Martinez (Universidad de Chile, Chile). Comments from the following SC members are gratefully acknowledged: John Benzie (University College Cork, Ireland) and C.V. Mohan (Network of Aquaculture Centres in Asia-Pacific, Thailand).

For the Chapter on food processing and food safety (nr. 5), the FAO Focal Points were Rosa Rolle (Regional Office for Asia and the Pacific), who coordinated parts relevant to biotechnology applications in food processing, and Masami Takeuchi (Nutrition and Consumer Protection Division), who coordinated parts relevant to biotechnology applications in food safety. Lead consultants were Olusola Oyewole (University of Agriculture, Abeokuta, Nigeria) and Ruud Valyasevi (National Center for Genetic Engineering and Biotechnology, Thailand). Comments from the following SC members are gratefully acknowledged: Kathleen Jones (Food and Drug Administration, United States), Marci Levine (International Life Sciences Institute, United States), Haruko Okusu (CGIAR Independent Science and Partnership Council, Italy), Masashi Kusukawa (Codex Alimentarius Commission, Italy) and Jørgen Schlundt (World Health Organization, Switzerland). Comments from the following FAO colleagues are gratefully acknowledged: Maria de Lourdes Costarrica, Sridhar Dharmapuri and Annika Wennberg (all from the Nutrition and Consumer Protection Division) and Adama Diallo (Joint FAO/IAEA Division, Austria).

For the Chapter (nr. 6) on the e-mail conference held as part of the build up to ABDC-10, the Background document to the e-mail conference (Part 6.2) was prepared by John Ruane and Andrea Sonnino (both from the IDWGB). Comments from the following external referees are gratefully acknowledged: Harinder Makkar (University of Hohenheim, Germany); Victor Martinez (Universidad de Chile, Chile); Denis Murphy (University of Glamorgan, United Kingdom) and Rajeev Varshney (International Crops Research Institute for the Semi-Arid Tropics, India). Comments from the following FAO colleagues are gratefully acknowledged: Zohra Bennadji (visiting scientist from the Instituto Nacional de Investigación Agrupecuaria, Uruguay), Nuria Alba Montfort (visiting scientist from the Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria, Spain) and Preetmoninder Lidder (IDWGB). The Summary Document to the conference (Part 6.3) was prepared by John Ruane, and grateful appreciation is expressed to Harinder Makkar (University of Hohenheim, Germany) who provided the first draft of this document. Special thanks are extended to the 834 people who subscribed to the conference, in particular to the 83 people living in 36 different countries who contributed the 121 messages that were posted.

For Chapters 7-9, focusing on policy options (covering respectively targeting agricultural biotechnologies to the poor; enabling R&D for agricultural biotechnologies; and ensuring access to the benefits of R&D), the FAO Focal Point was John Ruane (IDWGB) and lead consultant was James Dargie (former Chair of the IDWGB). Comments from the following SC members are gratefully acknowledged: Bertrand Dagallier (Organisation for Economic Co-operation and Development, France); Denise Dewar (CropLife International, United States); Dominic Glover (Wageningen University, the Netherlands); Sharon Bomer Lauritsen (Biotechnology Industry Organization, United States); Susan Owens (Department of Agriculture, United States); Decio Ripandelli (ICGEB, Italy); Olivier Sanvido (Agroscope Reckenholz Tänikon Research Station, Switzerland); and Rajeev Varshney (International Crops Research Institute for the Semi-Arid Tropics, India). Comments from the following FAO colleagues are gratefully acknowledged: John Preissing (Office of Knowledge Exchange, Research and Extension); Dennis Bittisnich, Sridhar Dharmapuri and Masami Takeuchi (all from the Nutrition and Consumer Protection Division); and Nuria Urquia (Plant Production and Protection Division). Appreciation is expressed to M. Karembu and D. Wafula (both ISAAA AfriCenter, Kenya) for information concerning biotechnology policies in African countries and to N. Beintema (International Food Policy Research Institute, Italy) for providing the information on agricultural science and technology investments used in Chapter 8.

For the final FAO background document (Chapter 10) which built upon and integrated/synthesized information from the previous documents, the FAO Focal Point was Andrea Sonnino (ABDC-10 Secretariat) and the lead consultant was Charles Spillane

(National University of Ireland, Galway, Ireland). Comments from the following SC members are gratefully acknowledged: James Dargie (former Chair of the IDWGB); Denise Dewar (CropLife International, United States); Kathleen Jones (Food and Drug Administration, United States); Harinder Makkar (University of Hohenheim, Germany); E.M. Muralidharan (Kerala Forest Research Institute, India); Denis Murphy (University of Glamorgan, United Kingdom); Susan Owens (Department of Agriculture, United States); and Olivier Sanvido (Agroscope Reckenholz Tänikon Research Station, Switzerland). Comments from the following colleagues in FAO Headquarters are gratefully acknowledged: Christine Deane (CGIAR Independent Science and Partnership Council), Eva Hain (Commission on Genetic Resources for Food and Agriculture), May Hani (Office of Knowledge Exchange, Research and Extension) and Shivaji Pandey (Chair of the IDWGB).

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Opening remarks were kindly presented on the first day by Alvaro García Chávez, Secretario de Desarrollo Rural del Gobierno del Estado de Jalisco; Modibo Traoré, FAO Assistant Director-General, Agriculture and Consumer Protection Department; and Mariano Ruiz-Funes Macedo, Subsecretario de Agricultura, SAGARPA. Closing statements on the final day were kindly given by Modibo Traoré; Victor M. Villalobos, Director General, Inter-American Institute for Cooperation on Agriculture; and Salvador Fernández Rivera, Coordinador de Investigación, INIFAP. Presentations to the Plenary by Rodney Cooke, Director of the Operational Policy and Technical Advisory Division, IFAD; Thomas Lumpkin, Director General of the International Maize and Wheat Improvement Center, on behalf of the CGIAR; and Shakeel Bhatti, Secretary of the International Treaty on Plant Genetic Resources for Food and Agriculture, are also gratefully acknowledged.

The preparation of Chapters 11, 12 and 13, providing the outcomes of sector-specific, cross-sectoral and regional parallel sessions respectively, would not have been possible without the organizational, technical and presentational skills of the many panel members, facilitators and rapporteurs named in these Chapters, and their contributions are gratefully acknowledged. We would also like to thank all the people who participated actively in

the session discussions, assisted in report writing and who helped to develop and plan the session programmes. FAO is truly grateful to all of the people who contributed in so many ways to these 27 sessions.

The ten sector-specific sessions described in Chapter 11 were organized by FAO and the many members of the IDWGB who contributed to make these a success are gratefully acknowledged.

For most of the cross-sectoral and regional parallel sessions described in Chapters 12 and 13, FAO invited relevant IGOs and NGOs to organize them and the programme for the sessions was then developed by the organizers, with guidance from FAO. We would like to express here our gratitude to the organizations involved and the people working there who were the main contacts with FAO and who contributed behind the scenes to planning and organizing the sessions.

The three sessions on genomic resources, genomic applications and genetic resources respectively (Parts 12.2.1 to 12.2.3) were organized by the CGIAR and the main focal points were John McDermott (International Livestock Research Institute, Kenya), Dave Hoisington (International Crops Research Institute for the Semi-Arid Tropics, India) and Jean-Marcel Ribaut (Generation Challenge Programme, Mexico). The sessions on the role of the farmer and on public-private partnerships (Parts 12.2.4 and 12.2.7 respectively) were organized by FAO with support from the International Federation of Agricultural Producers (IFAP) and the main focal points were Nora Ourabah and David King (both from IFAP, France).

The session on ensuring equitable access to technology (Part 12.2.5) was organized by Oxfam International and the main focal point was Gigi Manicad (Oxfam Novib, the Netherlands). The session on public participation (Part 12.2.6) was organized by IUCN and the main focal point was Keith Wheeler (IUCN Commission on Education and Communication, United States). The session on biosafety in the context of biosecurity (Part 12.2.8) was organized by the FAO Nutrition and Consumer Protection Division, and the main focal points were Ezzeddine Boutrif and Masami Takeuchi (both from this Division, Italy).

The session on intellectual property rights (Part 12.2.9) was organized by the World Intellectual Property Organization (WIPO) and the main focal point was Anja von der Ropp (WIPO, Switzerland). The session on biotechnology policy coherence at the regional level (Part 12.2.10) was organized by the United Nations Conference on Trade and Development (UNCTAD) and the main focal points were Angel Gonzalez Sanz and Constantine Bartel (both UNCTAD, Switzerland). The session on non-food uses of plants (Part 12.2.11) was organized by the United Nations Industrial Development Organization (UNIDO) and the main focal points were Magnus Bosse and George Tzotzos (both UNIDO, Austria). The session on capacity building (Part 12.2.12) was organized by the ICGEB and the main focal point was Decio Ripandelli (ICGEB, Italy).

Regarding the five regional parallel sessions, the session for Latin America and the Caribbean (Part 13.2.1) was organized by the Inter-American Institute for Cooperation on Agriculture (IICA), the International REDBIO Foundation (FRI) and the Technical Cooperation Network on Agricultural Biotechnology in Latin America and the Caribbean (REDBIO), and the main focal points were Ramón Lastra (IICA, Costa Rica), Alicia Diamante (FRI, Argentina) and Juan Izquierdo (FAO Regional Office for Latin America and the Caribbean, Chile).

The West Asia and North Africa session (Part 13.2.2) was organized by the Association of Agricultural Research Institutions in Near East and North Africa (AARINENA), and the main focal point was Ibrahim Hamdan (AARINENA, Jordan). The Sub-Saharan Africa session (Part 13.2.3) was organized by the Forum for Agricultural Research in Africa (FARA) and the main focal points were Monty Jones and Walter Alhassan (both FARA, Ghana). The Asia-Pacific session (Part 13.2.4) was organized by the Asia-Pacific Association of Agricultural Research Institutions (APAARI) and the main focal points were Raj Paroda (APAARI, Thailand) and Jawahir Karihaloo (APAARI, India). The Europe and Central Asia session (Part 13.2.5) was organized by the FAO Regional Office for Europe and Central Asia (REU) and the main focal point was Nevena Alexandrova (REU, Hungary).

ABBREVIATIONS AND ACRONYMS

AARINENA	Association of Agricultural Research Institutions in the Near East and North Africa
AATF	African Agricultural Technology Foundation
ABDC-10	FAO international technical conference on Agricultural Biotechnologies in Developing Countries
ACIAR	Australian Centre for International Agricultural Research
AFLP	Amplified fragment length polymorphism
AGORA	Access to the Global Online Research in Agriculture
AI	Artificial insemination
AIA	Advance informed agreement
APAARI	Asia-Pacific Association of Agricultural Research Institutions
ARC	Agricultural Research Council (South Africa)
ARS	Agricultural Research Service (USDA)
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
ASEAN	Association of Southeast Asian Nations
AVRDC	Asian Vegetable Research and Development Center
AW-IPM	Area-wide integrated pest management
BCH	Biosafety Clearing House
BecA	Biosciences eastern and central Africa
BFA	Biotechnologies in food and agriculture
BMP	Better management practice
BRAC	Building Resources Across Communities (an NGO in Bangladesh)
Bt	Bacillus thuringiensis
CARICOM	Caribbean Community and Common Market
CBD	Convention on Biological Diversity
CBOL	Consortium for the Barcode of Life
cDNA	Complementary DNA
CGIAR	Consultative Group on International Agricultural Research
cGRASP	Consortium for genomics research on all salmon project
CIAT	International Centre for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Center
CIP	International Potato Center
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement
CMVD	Cassava mosaic virus disease
COMESA	Common Market for Eastern and Southern Africa
CPB	Cartagena Protocol on Biosafety
CSF	Classical swine fever
CSO	Civil society organization
DADF	Department of Animal Husbandry, Dairying and Fisheries (India)
DBT	Department of Biotechnology (India)
DFID	Department for International Development (United Kingdom)
DIVA vaccine	Vaccine that differentiates infected from vaccinated animals
ELISA	Enzyme-linked immunosorbent assay
EM	Ectomycorrhizae
EMBL	European Molecular Biology Laboratory
EMBRAPA	Brazilian Agricultural Research Corporation
EST	Expressed sequence tag
ET	Embryo transfer
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FARA	Forum for Agricultural Research in Africa
FDA	U.S. Food and Drug Administration
FMD	Foot-and-mouth disease
FPR	Farmer participatory research
FTAI	Fixed-timed artificial insemination

FTO	Freedom to operate
GC	Gas chromatography
GDP	Gross domestic product
GEF	Global Environment Facility
GFAR	Global Forum on Agricultural Research
GHP	Good hygienic practice
GIS	Geographic information systems
GMM	Genetically modified micro-organism
GM(O)	Genetically modified (organism)
GMP	Good manufacturing practice
GREP	Global Rinderpest Eradication Programme
GRFA	Genetic resources for food and agriculture
GURTs	Genetic use restriction technologies
HACCP	Hazard analysis and critical control point
HPAI	Highly pathogenic avian influenza
HPLC	High performance liquid chromatography
IAASTD	International Assessment of Agricultural Knowledge, Science and Technology for Development
IAEA	International Atomic Energy Agency
IAH	Institute for Animal Health (United Kingdom)
ICAR	Indian Council of Agricultural Research
ICARDA	International Center for Agricultural Research in the Dry Areas
ICGEB	International Centre for Genetic Engineering and Biotechnology
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDB	Inter-American Development Bank
IDWGB	FAO Interdepartmental Working Group on Biotechnology
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IHHNV	Infectious hypodermic and haematopoeitic necrosis virus
IICA	Inter-American Institute for Cooperation on Agriculture
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
INIFAP	Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (Mexico)
IP	Intellectual property
IPGRI	International Plant Genetic Resources Institute (now called Bioversity International)
IPM	Integrated pest management
IPNV	Infectious pancreatic necrosis virus
IPPC	International Plant Protection Convention
IPR	Intellectual property rights
IRRI	International Rice Research Institute
ISAAA	International Service for the Acquisition of Agri-Biotech Applications
ISH	In situ hybridization
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
IUCN	International Union for Conservation of Nature
IVEP	In vitro embryo production
IVF	In vitro fertilization
JECFA	Joint FAO/WHO Expert Committee on Food Additives
KARI	Kenya Agricultural Research Institute
LMO	Living modified organism
MAS	Marker-assisted selection
MDG	Millennium Development Goal
MNC	Multinational corporation
MOET	Multiple ovulation and embryo transfer
MS	Mass spectrometry
MSSRF	M S Swaminathan Research Foundation
MSV	Maize streak virus
MTA	Material transfer agreement
NARI	Nimbkar Agricultural Research Institute (India)
NARS	National agricultural research systems

NBS	National biotechnology policy/strategy
NCBI	National Center for Biotechnology Information (United States)
N_e	Effective population size
NEPAD	New Partnership for Africa's Development
NERICA	New Rice for Africa
NGO	Non-governmental organization
NWS	New World screwworm
OECD	Organisation for Economic Co-operation and Development
OIE	World Organisation for Animal Health
OWS	Old World screwworm
PBR	Plant breeders' rights
PCR	Polymerase chain reaction
PPB	Participatory plant breeding
PPP	Public-private partnership
PPR	Peste des petits ruminants
PVP	Plant variety protection
qPCR	Quantitative PCR (also known as real-time PCR)
QTL	Quantitative trait locus
R&D	Research and development
RAPD	Random amplified polymorphic DNA
rBST	Recombinant bovine somatotropin
REDBIO	Technical Cooperation Network on Agricultural Biotechnology in Latin America and the Caribbean
REDD	Reducing emissions from deforestation and forest degradation
RFLP	Restriction fragment length polymorphism
RT-PCR	Reverse transcriptase PCR
S&T	Science and technology
SAGARPA	Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (Mexico)
SAGPyA	Secretaría de Agricultura, Ganadería, Pesca y Alimentos (Argentina)
SC	Steering Committee (of ABDC-10)
SCNT	Somatic cell nuclear transfer
SE	Somatic embryogenesis
SIT	Sterile insect technique
SME	Small and medium enterprise
SNP	Single nucleotide polymorphism
SPF	Specific pathogen-free
SPS Agreement	WTO Agreement on the Application of Sanitary and Phytosanitary Measures
SWOT	Strengths, weaknesses, opportunities and threats
TILLING	Targeting induced local lesions in genomes
TLC	Thin layer chromatography
TRIPs Agreement	WTO Agreement on Trade-Related Aspects of Intellectual Property Rights
TSV	Taura syndrome virus
TTO	Technology transfer office
TWAS	Academy of Sciences for the Developing World
UNCTAD	United Nations Conference on Trade and Development
UNDAF	United Nations Development Assistance Framework
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
UPOV	International Union for the Protection of New Varieties of Plants
USDA	United States Department of Agriculture
VAM	Vesicular-arbuscular mycorrhizae
VITAA	Vitamin A for Africa
WHO	World Health Organization
WIPO	World Intellectual Property Organization
WSSV	White spot syndrome virus
WTO	World Trade Organization
YHV	Yellow head virus