

January 2010



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FAO International Technical Conference

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)

Guadalajara, Mexico, 1 – 4 March 2010

Agricultural Biotechnologies for Food Security and Sustainable Development: Options for Developing Countries and Priorities for Action by the International Community

Acknowledgements

This official FAO document is the result of the joint effort of many contributors. Its preparation was coordinated and the text of the draft document finalized by Andrea Sonnino, Senior Agricultural Research Officer in FAO's Research and Extension Division, in collaboration with John Ruane from the ABDC-10 Secretariat. Lead consultant for drafting of the document was Charles Spillane from the National University of Ireland, Galway.

Comments from the following members of the ABDC-10 Steering Committee are gratefully acknowledged: James Dargie (former Chair of the FAO Working Group on Biotechnology, Vienna, Austria); Denise Dewar (CropLife International, Washington, United States); Kathleen Jones (Food and Drug Administration, United States); Harinder P.S. Makkar (University of Hohenheim, Germany); E.M. Muralidharan (Kerala Forest Research Institute, India); Denis Murphy (University of Glamorgan, United Kingdom); Susan Owens (US Department of Agriculture, Washington, United States); Olivier Sanvido (Agroscope Reckenholz Tänikon Research Station, Zürich, Switzerland);

Contributions and comments on the document are also gratefully appreciated from several FAO colleagues, including Christine Deane (CGIAR Science Council), Eva Hain (Commission on Genetic Resources for Food and Agriculture), May Hani (Research and Extension Division) and Shivaji Pandey (Chair of the FAO Working Group on Biotechnology).

Executive Summary

Agricultural biotechnologies¹ provide opportunities to address the significant challenges of ensuring food security without destroying the environmental resource base. Because most of the world's poor live in rural areas, there is a need to facilitate greater access, for poor rural producers, to technologies that can increase the productivity of smallholder agriculture and help reduce rural poverty. This document highlights lessons learned, and options for the future for developing countries in relation to harnessing agricultural biotechnologies for food security and agricultural² sustainability. In addition, the document provides a series of Priorities for Action for consideration by the international community that focus on both policy and capacity development. These priorities can be related to the following overarching goals or principles:

Policy Goals or Principles

- To facilitate the development and adoption of agricultural biotechnologies that address the needs of poor rural producers and preserve the natural resource base.
- To develop and deploy biotechnologies for food security and poverty reduction in rural areas.
- To promote public and private sector investment in agricultural biotechnologies for greater impact on food security and rural livelihood.
- To develop science-based policies, regulation and standards which promote sustainability, and enable the positive impacts of agricultural biotechnologies on food security.
- To develop national capacities for generating, adapting and adopting agricultural biotechnologies that address the needs of poor rural producers and contribute to agricultural sustainability.
- To facilitate the access of smallholder farmers to agricultural biotechnologies that can contribute to food security and agricultural sustainability.
- To foster improved communication, information sharing and public participation practices regarding agricultural biotechnologies for food security.

Capacity Development Goals or Principles

- To facilitate regional and national policy-setting that enables biotechnologies for sustainable development, including food security and agricultural sustainability.
- To support the strengthening of national and international cooperation programmes and actions plans for agricultural biotechnologies for food security and agricultural sustainability.
- To facilitate multi-stakeholder approaches to policy development and planning for biotechnologies for sustainable development, including food security.
- To facilitate training and education for pro-poor agricultural biotechnology development and implementation, for food security and agriculture sustainability.
- To facilitate the uptake of agricultural biotechnologies that address food security and agricultural sustainability.
- To promote linkages of agricultural biotechnologies to other sectors, in support of food security and poverty reduction.

¹ Agricultural biotechnologies encompass any technological applications that use biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use in food and agriculture. There is a wide range of agricultural biotechnologies available, one of which is genetic modification.

² For the purpose of this document, the term agriculture includes the crop, livestock, fisheries and aquaculture, forestry, and food processing sectors.

1. Introduction

1. The FAO International Technical Conference on Agricultural Biotechnologies in Developing Countries (ABDC-10) takes place against the backdrop of a series of global food, energy, environmental and financial crises. There are a range of alarming statistics and negative trends concerning rural poverty, hunger and food insecurity, food and energy demand, the carbon footprint of agriculture, climate change, and degradation of natural resources (such as land, water and biodiversity) that present serious challenges to society.

2. Over recent years, there has been a steady succession of authoritative high-profile reports and intergovernmental declarations³ detailing the immense challenge of sustainably feeding the world's growing population, without destroying the environmental resource base⁴. The urgency of the challenges highlighted in such declarations, reports and statements raises serious concerns about the adequacy of "business-as-usual" approaches to meeting these challenges, in particular if countries are to make more rapid advances to meet the targets of the Millennium Development Goals and other internationally agreed policies.

3. The vast majority of the world's hungry live and work in rural areas. Three of every four poor people in developing countries live in rural areas; 2.6 billion live on less than \$2 a day and 880 million on less than \$1 a day. Most of the poor rural producers depend on agriculture for their livelihood, either directly or indirectly through rural off-farm activities. Meeting the challenges ahead will require significant increases in investment in agricultural research in developing countries, and major refocusing of agricultural research activities towards strengthening the food security of the rural poor. In particular, addressing food insecurity will require policies, strategies, programmes, including the generation and dissemination of knowledge and technologies that can: (a) stimulate widespread and long-term increases in the production and value of staple foods and income-generating rural products through enhanced productivity; (b) develop sustainable agricultural systems that do not degrade the environmental resource base; (c) ensure food safety and nutritional quality that protects the health of consumers; and (d) promote improved access to, and engagement with, markets for smallholders.

4. Technologies and knowledge that increase agricultural productivity, facilitate diversification and the marketing of agrifood products, and improve natural resource management can be powerful forces for reducing poverty, hunger, food insecurity and environmental degradation. The five sector-specific papers prepared by FAO for ABDC-10 document the current status and options regarding the wide range of agricultural biotechnologies currently used in crops, livestock, fisheries/aquaculture, forestry and food processing/safety in developing countries, *inter alia*, to increase production, diagnose and manage diseases and conserve genetic resources for food and agriculture.

5. The sector-specific papers highlight that while there have been some notable agricultural biotechnology successes with demonstrated impacts on the livelihoods of poor rural producers in developing countries, many agricultural biotechnologies (especially newer technologies developed within past decade) have, as yet, had little impact in most developing countries or, with few exceptions, on the farming systems and incomes of the rural poor. Such a lack of access by poor rural producers to advanced technologies exists in a broader context of lack of access to more basic science and technology innovations, including electricity, healthcare and sanitation.

³ For example, the G8 L' Aquila Joint Statement on Global Food Security stated that "*Effective food security actions must be coupled with adaptation and mitigation measures in relation to climate change, sustainable management of water, land, soil and other natural resources, including the protection of biodiversity*". It was further highlighted that sustained and predictable funding and increased targeted investments are urgently required to enhance world food production capacity if sustainable global food security is to be achieved.

⁴ Most recently, the Declaration of the World Summit on Food Security
[www.fao.org/fileadmin/templates/wsfs/Summit/Docs/Final_Declaration/WSFS09_Declaration.pdf]

6. Building on the five sector-specific documents, and a sixth FAO document on policy options, this FAO document synthesizes the lessons learned and options available to developing countries for making informed decisions regarding adoption of agricultural biotechnologies within their national food security and rural development plans and policies. It also presents a set of Priorities for Action for the international community regarding agricultural biotechnologies for food security in developing countries, focusing on policy- and capacity-development actions.

2. Lessons Learned and Options for Developing Countries

2.1 Current status of impact of agricultural biotechnologies on food security

7. **Recent scientific and technological advances have developed products and techniques that can contribute to addressing food security and agriculture sustainability.** Some agricultural biotechnologies are already benefiting smallholder farmers in some developing countries. Available or pipeline products and techniques developed through biotechnology can potentially contribute to addressing present and emerging challenges facing poor rural producers.

8. **Application of agricultural biotechnologies is not yet widespread in developing countries.** Many existing agricultural biotechnologies (and other technologies) have not yet been adopted or adapted for the benefit of the majority of poor rural producers. Some developing countries remain excluded from biotechnology developments and benefits.

9. **Spillovers of proprietary agricultural biotechnologies for the benefit of smallholders have to date been minimal.** Technology spillovers from research innovations in agricultural biotechnologies have so far had limited impact on the livelihoods of the majority of the rural poor in developing countries. Most poor rural producers have limited access to technological advances and other inputs in all areas of agricultural research, including lack of access to basic science and technology innovations across many areas.

10. **Public sector research has developed some agricultural biotechnologies that address food security and agriculture sustainability, but has not always been sufficiently focused on the needs of poor rural producers.** The most enduring successes to date have come from long-term national and international (e.g. the Consultative Group on International Agricultural Research, CGIAR) public sector agricultural improvement programmes addressing farmer-relevant problems. However, even where there was strong development of agricultural biotechnologies within the public sector in developing countries, they have not always been directed at or made available for improving the livelihoods of poor rural producers.

11. **Some sectors of relevance to food security remain relatively neglected in terms of agricultural biotechnologies.** The application of biotechnologies in developing countries seems relatively more widespread in crops, livestock and food processing than in forestry and fisheries/aquaculture. These important areas tend to be somewhat neglected, though it should be noted that applications of biotechnologies are of much greater significance in planted forests than in naturally regenerated tropical forests, and in aquaculture than in capture fisheries. This is also reflected in terms of private sector investment, where there are e.g. fewer companies involved in forestry and aquaculture biotechnologies than in crop biotechnologies. Also within each sector, investments in biotechnology research and development focus more on products and techniques relevant to large-scale, commercial agriculture, while insufficient attention is paid to biotechnology products and techniques that can address the problems of poor rural producers.

2.2 Development of integrated and coordinated national plans on agricultural biotechnologies for food security

12. **Need for a clear vision for the role of agricultural biotechnologies in relation to national development needs, including food security.** It is important for governments to clarify and decide what role they envisage for agricultural biotechnologies in helping to meet national needs (both short- and long-term).

13. **Planning for agricultural biotechnologies is of cross-cutting relevance to national development plans and strategies.** It is essential that policies and plans regarding agricultural biotechnologies are coherent with other national policies and plans, and also in support of agreed international policies and targets. Some goals and objectives of National Development Plans (including long-term visions and 10-year plans), Poverty Reduction Strategies and sector programmes (e.g. in Agriculture, Health, Education) can be supported by harnessing agricultural biotechnologies for national needs.

14. **Promote biotechnologies as a common platform to leverage cross-sectoral innovations that meet national needs, including food security needs.** To maximize the impact of the use of existing biotechnology capacity across all sectors, planning for the development and utilization of biotechnologies should be integrated across all planning processes leading to national development plans as well as processes leading to sector-specific plans for agriculture, food/nutrition, health, education, economic development, poverty reduction, and the environment.

15. **Establish a National Biotechnology Policy/Strategy Framework.** A National Biotechnology Strategy should provide a shared long-term vision and a coherent integrated framework describing clear principles, priorities, objectives and actions. Objectives should be specific, measurable, achievable, realistic and time-bound, with performance indicators against which progress can be measured. All sectors should be represented in the National Biotechnology Strategy, including the crop, livestock, fish, forestry and food sectors. In some instances, regional frameworks may be an appropriate option to harmonize biotechnology strategies and maximize the utilization of capacity, particularly in poorer or resource-limited regions.

16. **National science and technology policies/strategies which include biotechnology must also address the food and agriculture sector.** There is a tendency for biotechnology to be narrowly equated with the biomedical (pharmaceutical) and industrial sectors. Where biotechnology is a component of an overall national science and technology strategy, it is important that all sectors and subsectors (for which biotechnology innovations are a cross-cutting issue) are represented in terms of their needs.

17. **Ensure that agricultural biotechnologies are not considered in isolation from broader agricultural advancement efforts.** Agricultural biotechnologies need to be built upon existing agricultural research systems and capacities. Biotechnologies in any sector (including agriculture) are typically not “stand-alone” alternatives to existing research, and cannot substitute existing agricultural research programmes. To deliver food security impacts for poor rural producers and consumers, agricultural biotechnologies need to be integrated within well-functioning agricultural research and innovation systems.

2.3 Priority-setting to enable agricultural biotechnologies to better meet national needs regarding food security

18. **Priority-setting and monitoring systems for the development, adoption and impact of agricultural biotechnologies are needed.** Priority-setting systems are necessary to identify areas of focus where interventions in agricultural biotechnologies could have maximum impact. Decision-making regarding research and innovation priorities should be based on needs (demand-driven), be transparent, and evidence-based. Regular foresight and horizon-scanning systems regarding agricultural biotechnologies should be used to inform national strategies, plans and sector-specific plans, along with frequent consultations with intended beneficiaries.

19. **Clear targets and performance indicators are required to measure uptake and the impact of agricultural biotechnologies on meeting food security needs.** For strategic planning, impact-assessment targets and indicators regarding agricultural biotechnologies can be “mainstreamed” across multiple national and sector-specific plans. Indicators should not only include typical science and technology metrics such as numbers of skilled personnel, publications, innovations developed, etc., but also include broader metrics to measure socio-economic outcomes and the impact of different agricultural biotechnologies on land productivity, incomes, food security and livelihoods.
20. **Need for regular periodic assessments of costs and benefits of different agricultural biotechnologies over the longer term.** Cost-benefit ratios for agricultural biotechnologies will change over time. There can be inherent risks for resource-limited developing countries to be either the early or late adopters of specific agricultural biotechnologies. Rigorous cost-benefit analysis should be conducted periodically on a systematic ongoing basis to assess possible impacts on food security and agriculture sustainability, in order to inform decision-making. A key issue is to determine which institutions have capacity and expertise to do this while also effectively interfacing with decision-makers.
21. **Reliable *ex-post* assessments of the impact of recent innovations in agricultural biotechnologies may not yet be possible.** Assessing the value of innovations from newer agricultural biotechnologies is difficult due to a lack of accumulated data and evidence across many regions, seasons and countries. For many of the newer products of agricultural biotechnologies (e.g. transgenic varieties, new breeds and strains, biocontrol agents, field-level diagnostic kits, vaccines and bioprocessing enzymes or microbes) the information related to their on-farm application and socio-economic impacts in developing countries either is insufficient or is scattered and not generalizable.
22. **Need to keep pace with evolving different agricultural biotechnologies and with the rate at which they become practical realities.** To assess impacts of different agricultural biotechnologies it is necessary to make clear distinctions between mature “on-the-shelf” versus “pipeline” biotechnologies. This highlights a need for continual monitoring of which agricultural biotechnologies are coming to maturity over time. Such monitoring requires scientists and technical advisors with the expertise to assess both the merits and limitations of different agricultural biotechnologies over time.
23. **Distinguish between invention and innovation in agricultural biotechnologies, and consult with end-users.** It is important to make a distinction between “invention” (the creation of new knowledge) and “innovation” (in the sense of first, early or novel application) and recognize that there is a significant time lag and many critical steps before inventions can be realized as practical innovations. Priorities for innovation in agricultural biotechnologies should be both assessed and set by a range of stakeholders, including scientists and representatives of end-users of technology outputs (e.g. farmers, consumers).
24. **The balance of home-grown versus imported innovation in agricultural biotechnologies is a strategic issue.** All countries are inter-dependent with respect to technological innovations in food and agriculture. It can be important to emphasize home-grown technologies (where they are cost-effective) as they can be a catalyst for institutional/human capacity development, technology adoption and national regulatory systems development. However, depending on national priorities and available resources, there are strategic pros and cons in decisions to become originators or early, intermediate or late adopters of new technologies, including agricultural biotechnologies.
- 2.4 Promote public and private investments in agricultural research, including biotechnologies for food security**
25. **National-level investments in agricultural research, including biotechnologies, need to be increased in order to contribute to food security in developing countries.** National investment plans for agricultural biotechnologies should focus on contributing to meeting well-defined needs and aim to leverage a range of national and international financing, including both public and private

26. **A national policy vision defining the relative roles of the public and private sector is necessary for developing and deploying innovations in agricultural biotechnologies for different clients.** Specific responsibilities must be mapped out to identify which sectors and stakeholders are to address the needs of the poor rural producers in order to ensure that positive food security impacts are achieved from capacity development and the deployment of agricultural biotechnologies. The limited purchasing power of the poor makes private sector investments in agricultural biotechnologies to meet their immediate needs unlikely. Each country needs to promote an appropriate mix of public, private and public-private partnership (PPP) financing that best meets its needs, and effectively communicate the underlying rationale to all stakeholders.

27. **Need to consider the role of intellectual property rights (IPR) in promoting innovation and restricting (unlicensed) access to proprietary agricultural biotechnologies.** IPR recognize the creativity of inventors by providing a temporary exclusive property right over inventions. As legal instruments, IPR promote private sector investment, while also requiring disclosure and dissemination of new innovations. IPR predominantly relate to the use of proprietary technologies in commercial markets. The effect of IPR systems in stimulating research investment, invention and innovation in each country and sector is a strategic issue, particularly in relation to what forms of innovation IPR promote and which stakeholders benefit from proprietary technologies. Lack of comprehensive and updated national IPR regulatory systems can limit the import of biotechnologies developed abroad.

28. **Determine whether and how IPR are likely to limit the freedom to innovate or trade in relation to agricultural biotechnologies.** Because many biotechnology innovations (and enabling technologies/tools) are subject to IPR, countries need to have the capacity to assess their freedom-to-operate (nationally and internationally) in terms of the IPR landscape for different biotechnology innovations. For IPR, this can apply to freedom to export products containing proprietary innovations into other jurisdictions, although freedom to export agricultural biotechnology products can also be affected through a range of other regulatory approval issues.

29. **Determine whether IPR are a critical barrier to technology adoption and the diffusion of agricultural biotechnologies for the poor.** IPR are a barrier to technology access whenever licensing is desired but not facilitated. Where assessments of needs for poor rural producers identify IPR-protected innovations that would be likely to benefit such farmers, subsidized or humanitarian exemption routes to the licensing of such proprietary innovations should be investigated.

30. **Improve aid effectiveness regarding agricultural biotechnologies through both national- and donor-level harmonization and coordination of donor-funded projects and programmes.** Coordination and harmonization of donor-support to agricultural research (including biotechnologies) can enhance the use and impact of resources at the national level. The Paris Declaration on Aid Effectiveness (2005) and the Accra Agenda for Action (2008) provide a framework for coordination of donor investments across all areas, including donor investments in agricultural biotechnologies.

2.5 Facilitate national and international linkages in agricultural biotechnologies that can strengthen food security

31. **Successful governance of biotechnologies requires well coordinated policies and strategies that address all stages of the innovation chain.** For agricultural biotechnologies to impact on meeting national development needs, approaches that consider the entire agricultural innovation system can have advantages over a fragmented project/programme-based approach (operating independently across different sectors and ministries). Such an approach considers national agricultural innovation systems, including the complete network of institutions across the public, private and informal sectors whose activities and interactions initiate, develop, import, modify and diffuse new technologies and innovations.

32. **Successful governance of biotechnologies requires horizontal and vertical systems of coordination.** Horizontal coordination is needed to ensure that different ministries can agree on the goals and objectives of a national system of innovation, including the role of agricultural biotechnologies, while vertical coordination is needed to ensure that the different sectors and subsectors (e.g. animal breeding, animal nutrition, forestry) are included in the process. Both horizontal and vertical coordination should occur across all levels from policy, institutional and field levels. Coordination mechanisms should include stakeholders from farmers' organizations, the business sector and NGOs representing poor rural producers.
33. **Lack of policy coherence and consistency across ministries and sectors can be a barrier to harnessing agricultural biotechnologies.** Lack of coherence in national and international policies and regulatory systems creates uncertainty, and can lead to reduced investments (public or private) in agricultural research and biotechnologies. For policy coherence, intersectoral policies in the scientific, economic, environmental and trade areas need to be mutually supportive and well coordinated.
34. **Foster links with other countries that can strengthen capacities for policy and regulatory analysis, planning, research and institutional development and technology flows in agricultural biotechnologies.** Improved North-South and South-South collaborations (e.g. using regional biotechnology centres such as the Biosciences East and Central Africa [BecA] hub) to facilitate capacity development and innovation are crucial. The nurturing of scientific, policy, administrative, NGO and business network building is essential for promoting strong national innovation systems that can effectively develop and adopt agricultural biotechnologies that contribute to food security.
35. **Leverage the capacity and knowledge in the agricultural biotechnologies of other countries in order to meet national needs.** When resources are scarce, it does not make sense to attempt to develop all innovations within one country. Strategies regarding agricultural biotechnologies that focus on adopting and adapting existing innovations to local needs need more effective international linkages, as do strategies based on the regional pooling of expertise and capacity.
- 2.6 Foster linkages between agricultural biotechnologies and other areas within national innovation systems*
36. **Promote stronger linkages between national research institutes and universities.** Disconnects can occur between higher education and training conducted in universities, and research conducted in national research institutes. Staff and student secondments and exchanges, and joint research projects between universities and research institutes (nationally and internationally) will promote mutual-learning, build networks and enhance training, research and the impact of agricultural biotechnologies on food security.
37. **Consider infrastructure development as a platform for technological learning and innovation.** Infrastructure development projects can be used as platforms for research and technological learning. Government procurement (tenders) can be made conditional on research, development and innovation occurring within the infrastructural project. This approach can be used to foster capacity development for research and innovation in agricultural biotechnologies.
38. **Share biotechnology platforms, resources and tools across agriculture, health and other sectors.** The cost efficiency of using expensive biotechnologies can be improved by using the same/similar biotechnology techniques and equipment across multiple countries, sectors or subsectors (e.g. the BecA facility, Kenya). Greater integration of publicly-funded biotechnology research platforms across biomedical, agriculture, food, environmental and industrial sectors is desirable.
39. **Integrate human health concerns to accelerate capacity development in agricultural biotechnologies.** Zoonotic threats to public health from domestic animal diseases have accelerated the strengthening of national animal disease diagnosis and control systems. The development of

biotechnological capacity for animal health and food safety testing can be pursued through closer relationships with the medical and epidemiology communities.

2.7 Promote evidence-based and multi-stakeholder policy development in agricultural biotechnologies for food security

40. **Involvement and constructive engagement of key stakeholder groups in development of policy and capacity in agricultural biotechnologies is important.** The engagement of multiple-stakeholders in the identification of key needs and the development of policies can lead to mutual learning and understanding regarding where agricultural biotechnologies can play a role in strengthening food security and agricultural sustainability.

41. **Evidence-based policy development is essential for decision-making regarding agricultural biotechnologies for food security.** While it is important to engage a broad range of stakeholder groups in policy-development processes, this should not lead to an erosion of the role of scientific (and other, including socioeconomic) expertise and evidence in the policy-development process.

42. **Policy and regulatory development regarding agricultural biotechnologies needs to balance both risks and benefits for the poor.** More emphasis and activity have been focused on developing policies and regulations related to preventing risks arising from GMOs than to facilitating the use of agricultural biotechnologies for the benefit of poor rural producers. Strengthening the voice of stakeholders representing poor rural producers to make informed (and independent) decisions regarding which biotechnologies they consider could benefit their livelihoods remains a critical need for developing pro-poor agricultural biotechnologies.

43. **Over-emphasis of and polarization within the “GMO debate” has distracted and diverted scientific and policy resources from focusing on the needs of poor rural producers.** The controversy regarding GMOs in food and agriculture over the past decade has had significant effects in stalling, reducing and redirecting some public sector research efforts in agricultural biotechnologies, including non-GMO biotechnologies, from addressing the needs of the poor rural producers, in addition to diverting significant scientific resources from research to regulation. The portfolio of investment across different types of agricultural biotechnologies (including GMOs) has to be assessed with reference to the needs of the poor rural producers, and the speed and cost of the delivery of benefits to them.

44. **Integrate the *Biosecurity* approach across agricultural biotechnology policies and regulations.** The *Biosecurity* approach is defined by FAO as a “strategic and integrated approach to analysing and managing relevant risks to human, animal and plant life and health and associated risks to the environment”. Biosafety regulations for agricultural biotechnologies should be coherent and in harmony with other national regulations and relevant international agreements, regional frameworks and standards, especially those related to plant and animal health, and also food safety. The *Biosecurity* approach can allow efficiency gains for regulatory bodies.

45. **Promote transparency and participation in all processes involving policy development and regulation regarding agricultural biotechnologies.** To build overall trust in policy-making and regulatory processes regarding agricultural biotechnologies, it is important to ensure transparency and participation in the decision-making processes of relevant stakeholder groups and organizations that represent the public at large. Appropriate communication strategies are needed to ensure informed and meaningful participation.

2.8 Develop national capacity in agricultural biotechnologies for food security

46. **Many developing countries have limited capacity to develop or use agricultural biotechnologies.** This relates to limited capacity to generate, adapt or utilize potentially beneficial

47. **Strategic strengthening of existing research, extension and regulatory systems will facilitate future innovations in agricultural biotechnologies.** Agricultural biotechnologies are best applied within existing research, extension and regulatory systems where scientific knowledge is already generated, documented and organized. The strengthening of existing agricultural research, extension and regulatory systems is necessary if agricultural biotechnologies are to be used successfully to contribute to food security and agricultural sustainability.

48. **Sustainable capacity development for agricultural biotechnologies will require both science-push (supply) and science-pull (demand) effects.** Poor rural producers and consumers have not been capable of exercising a strong science-pull to harness agricultural biotechnologies for their needs. The strengthening of the capacity of farmer organizations to interface with technology providers (whether public or private sector) is a key need.

2.9 Strengthen downstream systems that facilitate positive impacts of agricultural biotechnologies on the poor

49. **Strengthening existing channels/systems for technology access and adoption by poor rural producers is of paramount importance.** Development of agricultural biotechnologies should be strongly linked with strategies for dissemination, evaluation and adoption by poor rural groups that can benefit. Where such functioning “downstream” evaluation, dissemination and extension systems are not in place, investments in such systems will likely have greater initial impacts than investments in advanced agricultural biotechnologies, and should have at least equal priority.

50. **To interface with farmers, consider the reform of agricultural extension services towards more pluralistic and decentralized extension and technology advisory systems.** In recent years, agricultural extension systems have undergone significant and rapid changes, including in their financing and governance systems. Within the same country this can lead to better coordination of a diversity of advisory services within the public, private and NGO sectors, including farmer-led and farmer-participatory extension systems.

51. **If existing diffusion channels for enhanced agricultural technology are not functioning, it is unlikely that agricultural biotechnologies can reach poor rural producers.** Inefficient and gender-biased extension systems (public, private and informal sector) can represent a major hurdle for poor rural producers to gain access to enhanced germplasm, improved vaccines and other outputs from agricultural biotechnologies for agriculture and food production.

52. **Farmer-participatory approaches can improve the likelihood that agricultural biotechnologies reach and benefit poor end-users.** There are examples of the application of farmer participatory research approaches for better connecting agricultural biotechnologies with the needs of smallholders.

53. **Determine the critical barriers to technology adoption and the diffusion of agricultural biotechnologies to poor rural producers.** There is a need to identify key agricultural biotechnology innovations that could improve the income and food security status of poor rural producers, and to explore ways to overcome the many significant barriers that poor rural producers, especially women, face in gaining access to beneficial agricultural biotechnologies.

2.10 Strengthen communication and engagement with priority stakeholders

54. Information delivery to politicians and other decision-makers about the strategic importance of science and technology in general (and biotechnology in particular) is a key issue.

The promotion of political awareness of the relevance and limitations of agricultural biotechnologies for meeting national needs, including food security, is essential. Science communication and advisory mechanisms for politicians and other decision-makers are critical for ensuring that decision-makers are aware of technological opportunities, limitations and timescales and are better enabled to take informed decisions.

55. Communication is critically important for increasing public and political understanding and engagement regarding the role of different agricultural biotechnologies in relation to food security.

Knowledge and information are essential for people to successfully respond to the opportunities and challenges of technological changes. But to be useful, knowledge and information must be effectively communicated. A number of international policy instruments (e.g. Cartagena Protocol on Biosafety, Aarhus Convention) consider some issues regarding public awareness and participation regarding GMOs. It is critical that communication regarding all agricultural biotechnologies be accurate, balanced, participatory and science-based. Communication for Development (ComDev) methods and tools, which facilitate active participation and stakeholder dialogue, could be considered an essential component of any national innovation system.

3. Draft Priorities for Action by the International Community

56. In the context of ABDC-10, the term “international community” encompasses FAO and other United Nations (UN) organizations and bodies, non-UN intergovernmental and non-governmental organizations, international and regional organizations, including donors, development agencies, the private sector, philanthropic foundations and academic or scientific institutions⁵.

57. FAO Members can consider at ABDC-10 the following Priorities for Action by the international community regarding agricultural biotechnologies for food security. These Priorities for Action are intended to provide a framework for international cooperation and funding support for the generation, adaptation and adoption of agricultural biotechnologies in developing countries. At ABDC-10, Member States can provide guidance on these Priorities for Action. A recent international policy “gap analysis” study⁶ on agricultural biotechnologies for the FAO Commission on Genetic Resources for Food and Agriculture highlighted the lack of an international policy instrument providing guidance on how agricultural biotechnologies can be better harnessed for poverty reduction and food security.

58. These Priorities for Action should support the broader objectives of key internationally agreed policies. Governments have already adopted a series of resolutions and declarations in support of science and technologies, including on some occasions explicit references to biotechnologies in food and agriculture⁷. The most recent occasion was the World Summit on Food Security, where 60 Heads of State and Government and 191 Ministers from 182 countries and the European Community met at FAO headquarters in November 2009, unanimously adopting a Declaration which, *inter alia*, stated that “We recognize that increasing agricultural productivity is the main means to meet the increasing demand for food given the constraints on expanding land and water used for food production. We will seek to mobilize the resources needed to increase productivity, including the review, approval and adoption of biotechnology and other new technologies and innovations that are safe, effective and environmentally sustainable”.

59. It should be noted at ABDC-10 that while decisions related to adoption of technologies, including agricultural biotechnologies, are a prerogative and ultimate responsibility of each country, some policy issues regarding biotechnologies are already being addressed within a range of

⁵ This definition is derived from Agenda 21, Chapter 16 on Environmentally Sound Management of Biotechnology (<http://earthwatch.unep.ch/agenda21/16.php>).

⁶ Working Document CGRFA-11/07/13 [www.fao.org/nr/cgrfa/cgrfa-meetings/cgrfa-comm/eleventh-reg/en/]

⁷ See www.fao.org/biotech/abdc/about-abdc/rationale/

intergovernmental policy forums and frameworks, including *inter alia*: the Aarhus Convention (UN Economic Commission for Europe, UNECE); the Codex Alimentarius Commission (FAO/WHO); the UN Commission on Sustainable Development; the Convention on Biological Diversity and its Cartagena Protocol on Biosafety; the FAO Commission on Genetic Resources for Food and Agriculture; the International Treaty on Plant Genetic Resources for Food and Agriculture; the International Union for the Protection of New Varieties of Plants (UPOV); the UN Commission on Science and Technology for Development; the World Intellectual Property Organisation and the World Trade Organization (WTO).

60. In this section, the Priorities for Action to be considered are organized in three categories covering: priorities for policy-level decision-making; capacity development; and financing mechanisms and coordination options.

3.1 Policy Priorities

3.1.1 Developing and implementing international and national policies to facilitate pro-poor biotechnologies for sustainable development, including food security

61. Action: FAO Members can recommend at ABDC-10 to establish an international policy instrument (e.g. Plan containing Priority Actions) to be implemented by the international community specifically focused on agricultural biotechnologies for food security, which promotes broader international development policy goals.

62. Action: The international community can consider continuing to meet developing countries' requests for assistance in formulating strategic action plans for agricultural biotechnologies at the national and regional levels.

63. Action: Relevant intergovernmental bodies may wish to reaffirm their efforts to promote international policy coherence regarding agricultural biotechnologies for sustainable development and food security.

3.1.2 Supporting public and private sector investment in agricultural biotechnologies for greater impact on food security

64. Action: Donors and international funding agencies may wish to highlight the importance of public sector research in agricultural biotechnologies for food security and agriculture sustainability, and consequently consider dedicating an appropriate share of their assistance to promoting and strengthening public sector research capacity in agricultural biotechnologies in developing countries.

65. Action: The international community can continue to recognize the crucial role of the CGIAR as a provider of international public goods in research for development, including agricultural biotechnologies for food security, and continue its support for the CGIAR's work in this regard.

66. Action: The international community can consider promoting policies that facilitate increasing (or redirecting) public and private sector investment in agricultural biotechnologies towards the targets of reducing poverty, increasing food security and agricultural sustainability.

67. Action: The international community may wish to recognize the possible contribution of private sector investment, including in research and development, to food security programmes and endeavour to provide policy advice on 'good practice' models for public sector engagement in PPPs regarding agricultural biotechnologies.

68. Action: The international community may consider providing policy advice on the establishment of mechanisms and tools that assist the public sector and small to medium-scale enterprises in meeting regulatory requirements for the deployment of agricultural biotechnologies for food security.

69. **Action:** Relevant organizations can develop criteria and tools to better identify those areas where additional public sector support for agricultural biotechnologies for the poor is needed (e.g. areas relevant to non-commercial markets, food security, minor and orphan crops, poverty reduction).

70. **Action:** Relevant international organizations can consider providing assistance (with appropriate monitoring) to strengthen agricultural biotechnologies for food security and environmental sustainability in sectors such as forestry and fisheries that tend to be somewhat neglected.

71. **Action:** The international community can consider developing models to assist countries establish Orphan “crop, breed and farming systems” Acts (akin to Orphan Drug Acts) to promote greater investment in agricultural research on the crops, breeds and farming systems relevant for poor rural producers.

72. **Action:** The international community can consider within climate change adaptation frameworks, funding mechanisms to support, *inter alia*, innovations in agricultural biotechnologies that can help both counteract and mitigate the adverse effects of climate change, in order to better protect poor rural producers and consumers from the negative effects of climate change on their food security.

73. **Action:** The international community can promote complementarities between public and private sector financing of agricultural biotechnologies by more clearly defining the relative roles of the public and private sectors, particularly in terms of their relevance for delivering science and technology innovations to the rural poor.

3.1.3 Development of science-based policies, regulations and standards which promote sustainable agriculture, and maximize the benefits of agricultural biotechnologies for food security

74. **Action:** FAO, in cooperation with other international agencies, can collect, systematize and disseminate documentation on the development and adoption of agricultural biotechnologies and analyse their socio-economic impacts in developing countries. This includes the compilation of statistics, the establishment and maintenance of biotechnology application databases, studies etc. This is necessary to generate an evidence base for policy-makers on the cost-benefit implications of the application of different biotechnologies.

75. **Action:** FAO, in cooperation with other international agencies, can compile annotated collections of methodologies and tools for *ex-ante* analysis of the socio-economic impacts of development and adoption of agricultural biotechnologies in developing countries, in order to assist policy-makers in developing countries in decision-making about the adoption of biotechnologies.

76. **Action:** The international community may wish to reiterate the role of the relevant existing intergovernmental forums in addressing international policy issues regarding biosafety and *Biosecurity*, including food safety and plant and animal health, and trade matters relating to agricultural biotechnologies, particularly GMOs.

77. **Action:** The international community may consider increasing efforts to facilitate participation by developing countries in the three relevant international standard-setting organizations for the WTO Agreement on the Application of Sanitary and Phytosanitary Measures, namely the FAO/WHO Codex Alimentarius Commission (food safety), World Organisation for Animal Health (animal health) and the International Plant Protection Convention (plant health), all of which are addressing issues of relevance to agricultural biotechnologies.

78. **Action:** The international community may wish to continue supporting the concept that biosafety (regarding GMOs) be integrated within a broader *Biosecurity* approach.

79. Action: The international community may emphasize the fundamental importance of transparency and public participation when establishing and implementing biosafety or *Biosecurity* frameworks or policies.

80. Action: The international community can assist in promoting subregional/regional co-operation and harmonization for the establishment and implementation of biosafety or *Biosecurity* frameworks.

3.1.4 Facilitating access for poor rural producers and consumers to agricultural biotechnologies for food security

81. Action: Relevant intergovernmental forums can consider promoting policies to facilitate greater access for poor rural producers to products and processes of agricultural biotechnologies essential to food security.

82. Action: The international community can encourage the private sector, and its representative umbrella organizations, to endeavour to develop transparent mechanisms to facilitate low- and no-cost humanitarian access to proprietary biotechnologies, specifically for the purpose of strengthening food security in developing countries.

83. Action: Relevant intergovernmental bodies can consider whether there are creative ways to use international policy instruments to ensure that internationally agreed IPR policies better meet the needs of the poor.

84. Action: The international community can encourage private and public sector research institutions (including PPPs) to consider modifying terms of access to their proprietary agricultural biotechnologies so that such technologies can be better harnessed to meet the needs of poor rural producers in developing countries.

85. Action: Donors can consider supporting organizations and programmes that can provide strategic advice and capacity development to developing countries regarding IPR and agricultural technologies, including biotechnologies.

86. Action: The international community can consider further promoting access for developing countries to essential tools and enabling biotechnologies relevant for food security⁸.

87. Action: The international community can continue to recognize the role of the CGIAR in facilitating the access of poor rural producers to agricultural biotechnologies, and continue its support for the CGIAR's work in this regard.

3.1.5 Science communication, information dissemination and public awareness regarding agricultural biotechnologies

88. Action: FAO and other intergovernmental organizations can strengthen their activities related to gathering, analysing, systematizing and disseminating, among policy-makers and the public, unbiased science-based information on the generation, application and impact of agricultural biotechnologies for addressing food security and agricultural sustainability.

89. Action: The international community can promote ComDev approaches for facilitating multi-stakeholder dialogue and public engagement in priority-setting and decision-making on the adoption

⁸ e.g. through policy clauses regarding *ordre public* and morality in relation to protecting human, animal or plant life or health or to avoid serious prejudice to the environment (Article 27.2 of the WTO agreement on Trade-Related Aspects of Intellectual Property Rights).

of agricultural biotechnologies to increase food security and reduce poverty, and in support of international commitments and challenges.

3.2 Capacity Development

3.2.1 Facilitating regional and national policy-setting to enable biotechnologies for sustainable agricultural development, including food security

90. Action: Upon request, the international community can provide assistance to strengthen the capacity of developing countries for policy formulation and strategic planning in agricultural biotechnologies. Where appropriate, cross-sectoral strategies and frameworks can be developed, considering biotechnologies for agriculture, health, industry, and the environment.

91. Action: The international community can provide support for international, regional and national efforts to enhance understanding of agricultural biotechnologies among policy-makers and the public, particularly in relation to their existing or potential contributions to food security and agricultural sustainability.

92. Action: The international community can continue its efforts in meeting requests for assistance from developing countries to establish national regulatory frameworks and develop adequate institutional and human capacities in biosafety, food safety, plant health, IPR and traditional knowledge that are coherent with national development policies and in harmony with international obligations. The *Biosecurity* framework can be adopted and adapted where appropriate.

93. Action: The international community can continue to meet requests for assistance to enhance developing countries' capacities in facilitating regional collaboration and international harmonization of regulatory procedures relevant to agricultural biotechnologies.

3.2.2 Facilitate participatory multi-stakeholder approaches to policy development for biotechnologies for sustainable development, including food security

94. Action: Relevant international organizations, including the CGIAR, can strengthen the capacity of developing countries to engage stakeholder groups (that are representative and accountable to their members, particularly poor rural producers) in priority-setting and policy development in relation to agricultural biotechnologies.

95. Action: The international community can provide assistance for national priority-setting and consensus building efforts to identify key needs for food security, and facilitate assessments to identify where different agricultural biotechnologies can provide strategic options.

96. Action: International organizations can support the development of "transparency and good governance" principles and guidelines at national and regional levels for agricultural biotechnology policy-making and decision-making processes.

3.2.3 Support for strengthening national expertise and increasing international cooperation programmes and action plans for agricultural biotechnologies

97. Action: FAO and other specialized agencies can continue to provide support to developing countries to better assess their needs and priorities for agricultural biotechnologies, and to develop strategic action plans and programmes in agricultural biotechnologies for food security.

98. Action: FAO and other specialized agencies can meet the developing countries' requests to assist their National Agricultural Research and Extension Systems to strengthen their policies, institutions and human capacities in relation to generation, adaptation and adoption of agricultural biotechnologies for food security.

99. Action: The international community can provide support for regional groups of developing countries to build indigenous research, development, and advisory capacities for generating, assessing and adopting agricultural biotechnologies to address their food security needs.

100. Action: The international community can consider supporting the development of international cooperation programmes in specific areas identified to be of long-term strategic importance to the least developed countries (which may currently lack even the basic infrastructure to initiate such programs in the immediate future).

3.2.4 Training and education for pro-poor agricultural biotechnology development and implementation to strengthen food security

101. Action: The international community should consider providing support for the upgrading of education and training in agricultural biotechnologies, including incorporating food security and sustainability challenges into training curricula.

102. Action: Donors can consider supporting initiatives to broaden the access of researchers, students and stakeholder groups (including farmers' groups and private sector) in developing countries to scientific and technological knowledge sources in the arena of agricultural research, including agricultural biotechnologies⁹.

3.2.5 Facilitating the uptake of agricultural biotechnologies to strengthen food security

103. Action: Donors and development agencies should consider facilitating assessments of the capacity-strengthening needs of extension and communication systems (in public, private and informal sectors) as a component of providing assistance for capacity development in agricultural biotechnologies.

104. Action: Donors and development agencies can ensure that technical assistance involving agricultural biotechnologies has clear communication strategies and links to extension systems that can effectively reach the intended beneficiaries.

105. Action: Donors and development organizations should consider assisting developing countries in strengthening their capacity to facilitate smallholders' adoption of technical innovations, including innovations derived from agricultural biotechnologies, which can address food security and agricultural sustainability.

106. Action: The international community can endeavour to promote greater use of ComDev, farmer-participatory and farmer-led approaches for facilitating innovation regarding agricultural biotechnologies for food security.

3.2.6 Promoting linkages of agricultural biotechnologies to other areas, in support of food security

107. Action: The international community can ensure that technical assistance in agricultural biotechnologies supports effective and intimate links to strong agricultural research and extension programmes.

108. Action: Policies and programmes on agricultural biotechnologies should aim to ensure that investments in research in agricultural biotechnologies are not made at the expense of current expenditure in other agricultural research fields.

⁹ For example, the FAO initiative on Access to Global Online Research in Agriculture (AGORA) (www.aginternetnetwork.org)

109. Action: Donors and specialized UN agencies should consider facilitating more effective mechanisms for South-South collaboration regarding agricultural biotechnologies for food security, including: the training of scientists and technicians; joint research projects (pooling complementary resources to work on project of common interest); the transfer of technologies, protocols and materials; and the sharing of information relevant to the development and adoption of biotechnologies.

110. Action: Donors and specialized UN agencies should consider extending assistance for establishing mechanisms to disseminate agricultural biotechnologies developed in industrialized countries to developing countries (North-South collaborations, PPPs), including by continuing to support CGIAR efforts in this regard.

3.3 Financing Mechanisms and Coordination Options

111. The role of agricultural biotechnologies relative to identified needs and priorities is a key issue that has to be considered when determining optimal financial allocations relating to agricultural biotechnologies for development. Donors and specialized UN agencies can address the fragmentation of assistance in the area of agricultural biotechnologies by taking a more coordinated and integrated approach. The Paris Declaration on Aid Effectiveness and the Accra Agenda for Action commit aid donors and partners (recipients) to increasing efforts in the harmonization, alignment and management of donor support.

112. Frameworks between UN agencies that can be harnessed to improve the coordination of support to agricultural biotechnologies at the national level include the UN's "Delivering as One" pilot initiatives, launched in 2007 in eight pilot countries, and the UN Development Assistance Framework (UNDAF), the strategic programme framework for the UN country teams.

113. More specific to biotechnology, the 2003 UN General Assembly Resolution 58/200 took note of the Secretary General's proposal for an integrated framework for biotechnology within the UN system and the need to strengthen coordination between relevant organizations and bodies of the system in the area of biotechnology. The interagency cooperation network on biotechnology "UN-Biotech" resulted from this recommendation. UN-Biotech is coordinated by the UN Conference on Trade and Development and involves all UN agencies undertaking biotechnology-related activities.

114. Action: Donors may wish to consider improving aid effectiveness in the area of agricultural biotechnologies through coordination of assistance projects and programmes in agricultural biotechnologies at the national (and regional) level.

115. Action: The international community can promote greater use of the UN-Biotech coordination framework to enhance this interagency framework to ensure that agricultural biotechnologies can better contribute to food security.

116. Action: The international community can enhance their coordination efforts at the country level for integrated agricultural biotechnologies capacity development to support sustainable development.

117. Action: The international community can explore the wider use of the "Delivering as One" pilot initiative as a basis for working with governments to develop integrated planning systems for agricultural biotechnologies for sustainable development.

118. Action: The international community can explore and promote measures to use and coordinate biotechnologies for national development through UNDAF to achieve national food security objectives.

Acronyms and Abbreviations

BecA = Biosciences East and Central Africa

CGIAR = Consultative Group on International Agricultural Research

ComDev = Communication for Development

FAO = Food and Agriculture Organization of the United Nations

GMOs = Genetically modified organisms

IPR = Intellectual property rights

NGO = Non-governmental organization

PPP = Public-private partnership

UN = United Nations

UNDAF = UN Development Assistance Framework

WTO = World Trade Organization