SDC GUIDELINES ON GREEN BIOTECHNOLOGY (GBT)

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development and Cooperation SDC

Published by
Swiss Agency for Development and Cooperation (SDC) – ©2007
Thematic and Technical Resources Department
Freiburgstrasse 130
CH-3003 Bern, Switzerland

Authors
This guide has been elaborated by Dr. Katharina Jenny, Natural Resources and Environment (NRE) Division of SDC in collaboration with Dr. Othmar Kaeppeli, Centre BATS, 4058 Basel, Switzerland.

Translations
Clara Wubbe, Transit TXT, CH-1701 Fribourg, Switzerland
Patrick Albert Saari, Quito, Ecuador

Proof Reading
Dr. Jorge Rojas, Fundación PROINPA, Cochabamba, Bolivia
Theodore Wachs, Centre for Development and Environment (CDE), 3008 Bern, Switzerland

Layout design
Ana María Hintermann-Villamil,
webhint.ch, Beethovenstrasse 27, CH-3073 Gümligen, Switzerland

Printed by
Schlaefli & Maurer AG,
Bahnhofstr. 15, CH-3800 Interlaken, Switzerland

Order from
Swiss Agency for Development and Cooperation (SDC)
Freiburgstr. 130
CH-3003 Bern, Switzerland
info@deza.admin.ch
www.sdc.admin.ch

For further information, please contact the NRE, Division, snru@deza.admin.ch

This publication is also available in French and Spanish.

A. Why guidelines on Green Biotechnology?

The terms **"Green Biotechnology"** (GBT) and **"Plant Biotechnology"** are used synonymously, and in their broadest sense relate to the use of modern biotechnology methods of crop plant improvement, ranging from tissue culture to marker-assisted breeding. In a narrower sense, the terms refer to the use of genetic engineering in plant breeding. In what follows, we concentrate on genetic engineering of plants, as this is the most controversial issue in GBT.

Box 1: Green Biotechnology – a controversial issue

Green Biotechnology is a much disputed but rapidly emerging and far-reaching field of technology:

***Proponents** are convinced that genetic engineering of plants holds an enormous potential for sustainable increases in food production and quality.*

Opponents believe that genetically modified (GM) crops are harmful to the environment, that products pose a threat to human health and biodiversity, and that humans and the envi-ronment are sacrificed for the sake of revenues and shareholder value in a handful of global companies.

*Key issues of the debate are: **biosafety, environmental sustainability, ethics,** and real benefits **for developing countries.***

Modern technologies in plant breeding have far-reaching implications for trade **(trade liberalization)** and access to and free exchange of breeding material **(intellectual property)**. Consequently, GBT is a primary focus in a range of international organizations and conventions of which Switzerland is a member. The World Intellectual Property Organisation (WIPO) and the WTO deal with trade and Property Rights issues, and the FAO, the International Plant Protection Convention (IPPC), the Convention on Biological Diversity (CBD) and the Cartagena Protocol on Biosafety with biodiversity, biosafety and global food issues. All these international entities **promote responsible applications of GBT and none oppose GM crops.**

Worldwide acreage of GM crops is increasing rapidly and currently accounts for more than 7% of arable land. More advanced developing countries are becoming aware of the potential of GBT, and the increase in GM crop acreage and GBT research investments in countries such as China, India, Argentina, Brazil and South Africa is strong. On the other hand, many countries receiving food aid are confronted with questions of how to handle the import of GM food aid, especially if there is no effective national regulatory framework in place.

The above-mentioned countries are often role models for the poorer SDC partner countries, and therefore SDC staff may be confronted with a variety of GBT issues. Over the last 10 years, SDC has been seen as particularly active in fostering the international multi-stakeholder debate on GBT. The present document will help SDC staff to inform themselves about the current state of the art, major controversial issues, and SDC thinking, and thereby help them to formulate appropriate contributions, either in a national or international context.

B. What these Guidelines contain

Overall, the guidelines describe SDC's political commitment **(policy level)**, options for support to SDC's country offices and local partners **(implementation level)**, current and future programmes/projects and linkages to other thematic priorities, and the process of handling forthcoming requests for networking with relevant partners and stakeholders in the respective field **(service level).**

SDC's position on GBT is developed in a stepwise approach, consisting of two interlinked sets of information tailored to different uses. These are:

- **The Guidelines**, which summarise the basic principles, controversial issues, and strategic options, and
- **The Fact sheets,** which consist of a primary set of selected issues relevant for SDC staff at different levels. They are regularly updated, based on new developments in the political and technological fields (see section G, service level).

C. Green Biotechnology today and in the future

The current situation in developing countries

Production of genetically modified crops today is principally **limited to varieties of soybean, maize, canola and cotton.** The bulk of these varieties boast herbicide tolerance and disease resistance properties. As of today, the commercial market is served by six multinational research-based companies. GM crops are grown by approximately 10.3 million farmers in 22 countries. In 2006, more than 38% of the global GM crop area, equivalent to about 39 million hectares, was grown in emerging developing countries, namely China, India, Argentina, Brazil and South Africa. This continuous trend has implications for the future adoption of GM crops in other developing countries as well as in industrialised countries.

Although it varies widely in degree, there is a significant amount of **research by public research institutions** going on, focussing on local crop improvements for poor farmers and their communities, and industrial crops according to national priorities. However, there is a distinct lack of public sector capability in product development and technology transfer to small farmers. Lack of experience, capacity, and lack of funding to develop products based on new research, including but not limited to the ability required to elaborate and impose bio-safety regulations, are reasons for this. As a consequence, evidence of the overall benefits of GM crops in developing countries is scarce, except for some socio-economic studies on the impact of GM cotton in Africa, India and China. However, it is anticipated that GM technology will soon be approved for basic staples like rice in China and India.

Many countries have identified **genetic modification** of crops as an option to meet their **agricultural development priorities,** provided the GM technologies address hunger and malnutrition and enhance local technological capabilities.

However, some countries have taken strong positions against the use of GMOs and restricted their use in various ways. They consider that the potential benefits are uncertain and the risks not sufficiently known. These are the issues around which the current debate is taking place.

The controversy

In the box 2, the principal points of contention are listed, with counter-positioning of opposing opinions about certain aspects of Green Biotechnology.

Countries interested in using GM technology in agriculture need to develop policies and regulatory systems that take account of the issues and concerns in a manner that is feasible in their specific contexts. Many countries are setting up **biosafety regulatory frameworks** with international support under the scheme provided by the **Cartagena Protocol on Biosafety.**

However, even where developing countries have a biosafety regulatory system in place, the main difficulty arises in **implementation.** Often, national institutions are too weak to enforce regulations. Requirements such as assessing the socio-economic impacts on rural communities pose a challenge in themselves. National capacity-building efforts very much depend on close collaboration with donor communities and selected institutions in the industrialized world, including the CGIAR.

Box 2: Genetically modified crops and development – elements of the controversy

GM crops are vital to feed the world; risks depend on the use of technology and can be controlled.	*Versus*	*World hunger is a poverty issue; GM crops are not essential in alleviating poverty as they are associated with many risks.*
Benefits to farmers		
Increased yields of local crops; marginal soils can be cropped.	*Versus*	*GM technology will only be available for in-dustrial crops; local crops unattractive to companies; GM crops are not adapted to technological level of developing world.*
Less dependence on products from industrialized countries (e.g. fertilizers, herbicides, pesticides).	*Versus*	*Increased costs for small and subsistence farmers: New seeds every year; dependence on complementary herbicides and pesticides.*
Decrease in the use of herbicides and pesticides.		*Dependence on multinationals for seeds; reduction in the use of herbicides and pesticides uncertain.*
Risks to sustainable development of local communities		
Beneficial to development of local communities through marketing of surplus production and secondary businesses.	*Versus*	*Negative impact on livelihood of local communities owing to technology not adapted to small farmers' needs; impossible to qualify for high-price markets (organics, fair trade).*
Cropping systems and environmental risks		
GM technology can be made available for minor crops and local food crops.	*Versus*	*Loss of control of genetic resources and locally improved varieties.*
Coexistence with alternative agricultural practices possible.		*Displacement of local crops and agricultural practices; coexistence impossible.*
Environmental and human safety granted with specific measures.		*Uncertainty about environmental and longterm health effects (non-conformity with precautionary principle).*
Safety issues comparable to those of conventional breeding.		*New risks with GM crops; loss of crop plant diversity; pollution of centres of origin.*

Biosafety Regulatory Regimes and the Swiss Biosafety Framework

The most important international regulatory framework for Green Biotechnology are the **FAO Codex Alimentarius,** which sets standards for food safety, and the **Cartagena Protocol on Biosafety.** The Protocol regulates the transboundary movement of GMOs only, and calls on governments to establish their own national biosafety regulation. The focus is on regulating the import of GMOs into a signatory country, and requires the *advance informed agreement* of the country's authority. Consequently, it has an immediate effect on trade and trade related issues. Its guiding principle is the ***precautionary approach.*** This means that if the risks to the environment are serious, and understanding of those risks is inadequate, then steps should immediately be taken to minimise any possible damage, even if this means abandoning the project. As of December 2006, 137 nations, the majority of which are developing nations, had signed the Protocol or expressed their intention to do so.

Switzerland has one of the world's most restrictive biosafety regulatory frameworks. Its implementation is ensured through long-term liability for damages resulting from biotechnology applications, and through requiring comprehensive risk assessment according to the precautionary approach. Two federal committees – the Swiss Ethics Committee on Non-human Gene Technology (ECNH), and the Swiss Expert Committee for Biosafety (SECB) – as well as environmental organisations have the right to appeal release permissions. With regard to commercial cultivation of GM crops, Swiss policy is bound to a five-year moratorium that was approved by Swiss voters in a national referendum in 2005. The moratorium does not, however, exclude biotechnological research and import of genetically modified foods. With this regulatory background, Switzerland has accumulated valuable experience in a complex field, which can be used to advise and assist developing countries in establishing their own regulatory structures.

Challenges and Trends

The issues and concerns surrounding GM technology are complex, involving scientific, social, ethical, trade and political aspects. The processes of carefully balancing and weighing the potential benefits against the possible risks of GM crops, and arriving at a decision to approve or reject a particular application of GBT, presumes the existence of relevant and adequate capacity in several specific areas of knowledge. With some exceptions, few officially approved guidelines or policy papers exist on formal decision making.

International dialogue has proposed the use of an ***"informed decision-making process"*** to decide on the application of GBT. Such efforts are part of the endeavour to redirect biotechnology to address the needs of low-income families in developing countries and to involve all stakeholders in the decision-making process. **Biotechnology is considered one of the important tools in a larger portfolio of science and technology approaches to further sustainable development.**

In accordance with this approach, the acceptance of agricultural technologies based on genetic engineering should depend on the expression of local needs, involve a thorough **risk-benefit assessment,** and **be adapted to available capacities.** Local stakeholders must be part of the decision-making process.

Food Aid (GMO(s) in emergency operations)

The US is the largest producer of GM crops. In 2005, the percentage of GM soybeans accounted for 80 percent of all soy planted and 50 percent of all GM maize. Moreover, the US food system does not separate GM and non-GM crops. This is important, as the US provides 60 percent of all food aid donations, mostly made up of home-grown wheat, maize and soy-beans and channelled through the **World Food Programme** (WFP).

By mid 2002, this issue was the subject of a public debate following the rejection of food aid by some recipient countries in Southern Africa in the middle of the worst food shortage faced in 50 years. Recipient countries justified their response by citing concerns with regard to the safety of such food, the lack of a national regulatory framework, unintentional introduction of GM crop varieties into the region as a result of plantings or spillage of the grains provided as food aid, the related threat of losing export opportunities to the EU, and to a lesser extent the infringement of property rights regulations. Given the growing corporate concentration in the agricultural biotechnology sector and its close ties with specific government agencies, fears were compounded by the widespread perception that the introduction of GM crops as food aid serves donor countries' domestic economic and political interests.

The situation in Southern Africa has prompted the **WFP to set a policy on donations of GM food.** It is WFP policy that all donated food meets the food safety standards of both the donor and the recipient countries, and all applicable international standards, guidelines and recommendations. WFP operates on the principle that all governments have the right to choose to accept or reject GM food aid and, if accepted, set terms for the import of such food, exercising their sovereign right under the Cartagena Protocol. For example, if a recipient country requires milling to prevent the use of GM food aid as seed or, similarly, if a donor places restrictions on the purchase of GM food aid with a cash donation, the WFP fully honours these conditions.

In March 2006, the parties to the Cartagena Protocol approved a requirement for labelling of cross-border shipments containing living modified organisms (LMOs) in products for direct use as food or feed, or for processing. Under the new agreement, products that have been clearly identified and separated as transgenics will have to carry the label 'contains LMOs'. The US, however, as a non-party to the Protocol, may provide this information on a voluntary basis only.

Based on lessons learned in Southern Africa, the WFP also encourages and supports recipient countries in improving their national analytical capacities and biosafety framework, placing them in a position to carry out their own context-specific analyses of GM food. In addition, the WFP increasingly seeks alternative non-GM commodities or funding from all potential sources. It also anticipates that the necessary food can often be procured within the country concerned.

D. SDC objectives and principles on Green Biotechnology

SDC's mandate includes advancing sustainable agriculture for **food security, livelihood improvement,** and **pro-poor growth.** Achieving MDG1, namely halving the proportion of people who suffer from hunger and halving poverty, depends to a large extent on agricultural development. To meet this goal, SDC pursues the following objectives (adapted from SDC agriculture policy, 1999):

Box 3: Objectives of SDC agricultural policy

To contribute to the production of sufficient, safe and nutritious food for an increasing world population and to make it affordable for the poor.

To produce food in an environmentally friendly way, namely by using natural resources without undermining the developmental and environmental needs of present and future generations.

To ensure that all – men and women – have equal access to natural resources, services and legal entitlement, and that traditional knowledge is recognised by appropriate benefit-sharing mechanisms and participatory research and extension.

Farmers in developing countries face many problems that crops and agricultural technology alone cannot solve, such as political and socio-economic constraints, unequal benefit sharing, lack of infrastructure, management and husbandry, access to resources including good soil and water, and degradation of the natural resource base. Technology improvement is only one component, but often one that yields early returns to farmers. In this context, plant biotechnology is an additional tool.

SDC shares the view that GBT, including GM technology, **can never fully replace conventional breeding, but it can be an important tool in improving plant-breeding programmes.**

SDC recognises that GM crops might be able to improve agricultural productivity sustainably and enhance local and national food security with direct benefits for rural small holdings. For this to happen, governments in developing countries should commit substantial resources to public sector efforts in GBT. These investments should favour research and product development for the benefit of the poor. Often public-private partnerships are a good strategy to ensure sufficient levels of investment and know-how. The international development community has an important role to play in supporting partner countries in building the necessary capacity to develop, manage and use modern biotechnology in a safe and sustainable manner.

The desirability of GBT applications will be assessed in light of the following core principles (Box 4):

Box 4: SDC core principles for involvement in GBT

Food security: *Contributing to food security is part of the SDC mandate. If GBT allows important advances in this regard, SDC can support its application. The international agricultural research system (CGIAR) remains the principle partner for strengthening knowledge, innovation and capacity building. Investments in GBT should form part of an integrated and comprehensive public agricultural research and development programme that gives priority to the poor.*

Focus on smallholder farming systems, rural livelihoods, and gender: *The livelihoods of smallholder farmers have to be safeguarded. SDC will pay due attention to the impact of the agronomic and trade consequences of GM crops on smallholder livelihoods.*

National sovereignty: *GM crops are only one of many approaches available to contribute to food security. SDC respects and defends developing countries' sovereignty in assessing the desirability of GM crops within the context of their own local needs and priorities. SDC enhances the ability of partner countries to take informed decisions (see definition below). This includes paying due attention to alternatives and the appraisal of opportunities, potential benefits and potential risks associated with the development and application of GBTs and the involvement of all important stakeholders.*

Food aid: *SDC respects the sovereignty of individual states and adheres to the policy of the WFP, namely that GM food aid is offered only if the recipient country has given its informed consent. SDC supports, whenever applicable, food aid contributions purchased locally or regionally to strengthen local production and markets. According to the principles of the Cartagena Protocol, it also supports recipient countries in their national biosafety capacity building, so as to enable them to test GMOs independently on a context-specific basis.*

Non-exclusion*: Access to plant genetic resources for local communities will be safe-guarded. Traditional knowledge, and specifically the role of women in managing biodiversity, will be taken into account. The benefits accruing from the conservation of plant genetic resources in local systems will be shared fairly and equitably. SDC insists on non-discriminating intellectual property rights and transparent information for all.*

Box 5: Partners' own risk assessments

SDC supports a differentiated position with respect to GBT. Tenability of particular plant biotechnology applications should be assessed in an informed decision-making process at national level with the goal of promoting safe, sustainable and development-compatible plant biotechnology applications. The choices, however, must be made by policy makers in the partner countries.

Definition of informed decision making

An informed decision takes into account all available information from multidimensional risk-benefit assessments (e.g. safety, economic, social, environmental, ethical, cultural and development relevant aspects), considers technology alternatives (including inaction), is consistent with pertinent regulations and internal guidelines, and includes all major stakeholders.

5. SDC contributions to Green Biotechnology

The development of biotechnological applications takes place in a multidimensional environment, from policy setting through research to farm practice and vice versa. To ensure the safe development and application of GM technologies, a country must display capacities ranging from R&D in a number of specialised areas, including agronomy, nutrition, social sciences and legal disciplines and biosafety regulatory regimes, to GM-specific policies and instruments to implement them. SDC can support the development of local capacities at all these levels. Given the broad spectrum of support which may be requested, SDC is convinced that contributions to GBT must be addressed in a harmonised manner. Single donor initiatives that are not related to larger programmes of partner countries should normally be avoided. In its contribution to GBT, SDC's focus is on strengthening partners' capacity to arrive at informed decisions for approval or rejection of GM technologies. It is SDC's understanding that the partner has either started the process of establishing a biosafety regulatory regime or demonstrated its willingness to do so.

SDC will give support primarily in areas where it has a comparative advantage in doing so. These can stem from existing programmes established with national and international partners, and in particular the CGIAR, or from novel arrangements in public-private partnerships.

SDC is active at the policy, implementation and service level with similar intensity. Particular attention is given to linking experiences from all three levels.

Policy level

Engage in international and multilateral platforms

Objectives: Contribute to the creation of an internationally recognized crop research and development system with a specific focus on capacity building, biosafety assessment, access to technology and plant genetic resources, taking into account the conservation and use of plant genetic resources as well as the fair and equitable sharing of the benefits from the use of these resources.

Partners and focal areas: SDC aspires to be a leading partner in the implementation of the Global Crop Diversity Trust, a system that has been put in place for ex-situ germplasm conservation in perpetuity. SDC will continue to maintain close information exchange with the Swiss lead agencies of the CBD and the Cartagena Protocol (FOEN), and of the International Treaty on Plant Genetic Resources (FOAG). SDC contributes to policy dialogue through expertise and advice, strengthens the negotiation interests of developing country partners, and supports their participation in specific meetings as well as their programmes.

Assist partner countries in policy and priority setting

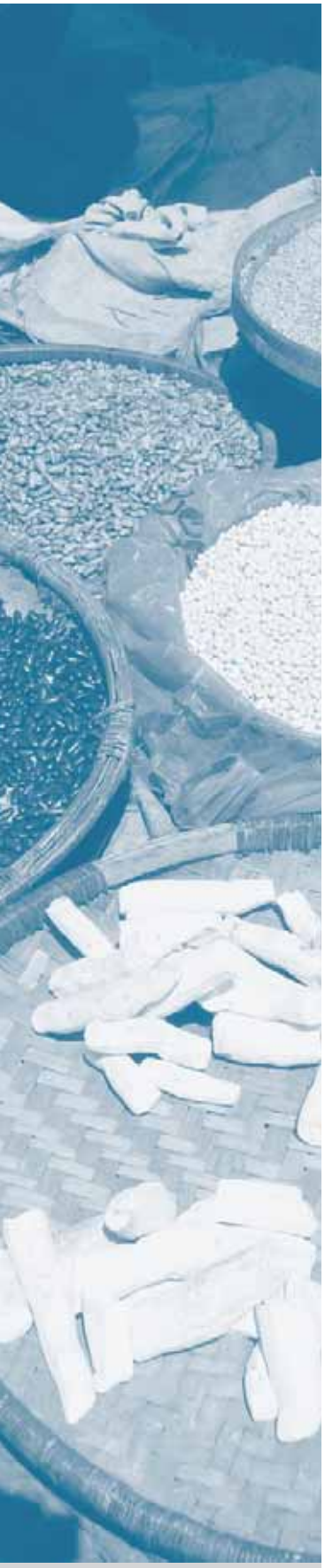
Objectives: Accompany and advise partner institutions in their evaluation processes for GBT introduction; facilitate the safe application of GBT.

Partners and focal areas: For this purpose, SDC will work primarily through recognized inter-national partners such as the Bioversity International (IPGRI) and the International Food Policy Research Institute (IFPRI) of the CGIAR. Exceptionally, upon specific request by the partner country and after careful evaluation of the local context, such support may be directly managed by SDC's Country offices.

Strengthen technical dialogue with developing countries

Objectives: Make available network knowledge for the identification of desirable applications of GBT and assurance of comprehensive project management.

Partners and focal areas: Such dialogue, e.g. on risk-benefit analyses for GM crops and identification of research partners for key areas, can be delegated to international partners, such as the CGIAR institutions or Swiss-based partners such as IUED, WTI, ZIL, SHL, FAL, and the EPFL. SDC plays a facilitating role.



Implementation level

Invest in capacity building for regulatory competence, biosafety and sustainability assessment

Objectives: Contribute to improved implementation and oversight of international agreements such as the **Cartagena Protocol** and the establishment of **National Biosafety Frameworks.**

Partners and focal areas: Capacity strengthening is designed for national partners in the **public research sector** in SDC's priority regions. This includes support for international research linked with national capacity building in the area of risk-benefit assessment and regulation. Areas of collaboration include development of practicable risk-benefit assessment tools and improvement of the scientific bases in public sector institutions (e.g. best practice guidelines, training, biosafety research, socio-economic analyses).

Support the innovation process in public agricultural research

Objectives: Objectives: Promotion of research agendas that serve smallholder needs and the strengthening of international agricultural research.

Partners and priority areas: SDC supports the CGIAR, CABI, FAO and other national/regional partners in the field. This includes advancement of integrated pest and sustainable crop management systems, with emphasis on orphan commodities. SDC participates in the relevant bodies and committees; ensuring that research will lead to development.

Explore the opportunity to work with the private sector

Objectives: Application of private sector findings to benefit poor farmers and facilitate access to proprietary technologies and knowledge.

SDC recognises the potential to mobilise science and other product development know-how which principally resides in the private sector for applications that may benefit poor farmers. SDC will support appropriate mechanisms to facilitate interaction of the public and private sectors to bring pro-poor technologies and products to the fields. This includes facilitating access to proprietary technologies and knowledge by exploring innovative cooperation in technology management such as development of new licensing mechanisms.

Service levels

Most SDC country programmes are in some way committed to rural income generation, livelihood support, agricultural value chain enhancement, or the promotion of sustainable agricultural production systems as key strategies of poverty reduction and pro-poor growth. In fragile states, emergency food aid is also repeatedly needed. In this context, SDC staff are confronted with questions concerning SDC's position with respect to GM crops and foods.

There is no general set of answers to country-related questions. Above all, safety, sustainability and the different dimensions of informed choices need to be assessed in view of local needs and constraints on a case-by-case basis. The nature of issues will vary considerably between crop varieties, pests, abiotic stresses, and markets.

The NRE-Division of SDC, together with its network of specialised international and national partner institutions involved in responsible assessment and application of GBT, offers policy, institutional and technical advice, capacity building, and support services to country offices based on individual requests.

The fact sheets form an integrated part of NRE's service provision. The initial set covers information about:

- Intellectual Property Rights,
- the Concept of Informed Decision Making,
- Innovations in GBT and Technological Trends,
- GMOs and Food Aid,
- Glossary Green Biotechnology and References/Useful Links,
- Swiss and International Regulations,
- Positions of Other Organisations, and
- SDC-supported Activities in GBT.

Additional topics will be covered based on request from SDC's country programmes or other stakeholders, or based on new developments in the political or technological field.

F. Guidelines, monitoring and adaptation

Validity

The guidelines will initially be valid for five years; the fact sheets are regularly updated and supplemented by selected issues.

Monitoring and adaptation

SDC's NRE Division is the unit responsible for follow-up on the policy process and for facilitating service and advisory/capacity building support in partner countries in cooperation with the country offices.

Revisions of the guidelines will be considered in cases of major context change.

G. Abbreviations

BATS	Center for Biosafety and Sustainability, www.bats.ch
Bioversity International	International Plant Genetic Resources Institute, www.bioversityinternational.org
Bt	Bacillus thuringiensis
CABI	Center for Applied Biosciences, www.cabi.org
CBD	UN Convention on Biological Diversity, www.biodiv.org
CGIAR	Consultative Group on International Agricultural Research, www.cgiar.org
CPB	Cartagena Protocol on Biosafety, www.biodiv.org/biosafety
ECNH	Swiss Ethics Committee on Non-human Gene Technology, http://www.ekah.ch/buwal/eng/fachgebiete/fg_ekah/index.html
EPFL	Ecole Polytechnique Fédérale de Lausanne, www.epfl.ch
FAL	Swiss Federal Research Station for Agroecology and Agriculture, Reckenholz, www.reckenholz.ch
FAO	Food and Agriculture Organisation of the United Nations, www.fao.org
FOAG	Federal Office for Agriculture, www.blw.admin.ch/index.html?lang=en
FOEN	Federal Office for the Environment, http://www.bafu.admin.ch
GBT	Green Biotechnology
GEF	Global Environment Fund, www.globalenvironmentfund.com
GM / OGM	Genetically Modified / Genetically Modified Organism
GMO ERA	Genetically Modified Organisms Environmental Risk Assessment, www.gmo-guidelines.info
IFPRI	International Food Policy Research Institute, www.ifpri.org
IPPC	International Plant Protection Convention, www.ippc.int
IPR	Intellectual Property Rights, www.ipr-helpdesk.org
IUED	Institut Universitaire d'Etudes du Développement, Genève CH, www.unige.ch/iued
LMOs	Living Modified Organisms
MDG	Millennium Development Goals, www.un.org/millenniumgoals
SECB	Swiss Expert Committee for Biosafety, http://www.efbs.ch/buwal/eng/fachgebiete/fg_efbs/start.html
SDC	Swiss Agency for Development and Cooperation, www.deza.ch
SHL	Swiss College for Agriculture, www.shl.bfh.ch
R&D	Research & Development
UNEP	United Nations Environmental Programme, www.unep.org
WFP	World Food Programme, www.wfp.org
WHO	World Health Organisation, www.who.org
WIPO	World Intellectual Property Organization, www.wipo.in
WTI	World Trade Institute, www.wti.org
WTO	World Trade Organisation, www.wto.org
ZIL	Centre for International Agriculture, www.zil.ethz.ch

Glossary

Biodiversity

The number and variety of plants, animals and other organisms that exist in nature.

Biotechnology

Technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use *(Definition by the CBD)*.

***Bacillus thuringiensis* (Bt)**

A naturally occurring bacteria that produces a protein toxic to certain types of insects. The gene inside the bacteria that is responsible for producing the toxin – the Bt gene – can be used as biological control agent against insects and as a transgene in GM crops, thereby making them more resistant to the corresponding insect.

Disease resistance

The capacity of a plant, usually determined by one or a few genes, to suppress or retard the activities of a disease-causing organism, usually a fungal, bacterial or viral pathogen.

DNA

The biochemical substance from which the genetic material of cells is made. DNA has a thread-like structure. The DNA in a plant or animal cell is in several long lengths called chromosomes, each of which contains many genes.

Food security

According to the FAO, a state in which all people at all times have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for a healthy life.

Genetic engineering

...is also known as recombinant DNA techniques. It is a branch of modern biotechnology. It entails a range of techniques used by scientists in an attempt to control or modify genes or, most controversially, move them between two unrelated species. Plants that have had the sequences of their genes changed are called genetically modified (GM) crops.

Genetically modified (GM) crops

Crop plant whose genetic makeup has been scientifically altered by genetic modification to produce desirable new traits or eliminate undesirable ones.

Gene

A linear fragment of DNA which contains the information needed to make proteins.

Genome

The entire complement of DNA (genes plus non-coding sequences) present in most cells of an organism.

Genomics

The study of an organism's genome and the use of the genes. It deals with the systematic use of genome information, associated with other data, to provide answers in biology, medicine, and industry.

Germplasm

Tissue from which new plants can be grown, for example seeds, pollen or leaves. Even a few cells may be sufficient to culture a new plant.

Green Biotechnology, GBT

...is modern biotechnology applied to agricultural processes. Green Biotechnology and Plant Biotechnology are used as synonyms and relate to crop plant modification involving genetic engineering. An example would include a crop plant genetically engineered to grow under specific environmental conditions or in the presence (or absence) of certain agricultural chemicals.

Herbicide

A substance that kills plants and is used to control weeds. Herbicides vary in their specificity. Some kill a broad spectrum of plant species, while others kill only specific species or groups of species.

Herbicide tolerance

This allows a plant to tolerate a herbicide that would otherwise kill it. This can be achieved by means of either genetic modification or conventional plant breeding.

Intellectual property

An intangible form of personal property. Copyrights, patents, and trademarks are examples of intellectual property. Intellectual property rights enable owners to select who may access and use their property, to protect it from unauthorised use and to recover income.

Introgression

The placing of a transgenic event into an established plant variety by traditional breeding, perhaps assisted by marker-assisted breeding.

Marker Assisted Breeding (MAB)
Molecular Breeding

Molecular breeding is a tool that involves the use of DNA markers for genes in combination with physical measurement of traits to accelerate selection in plant breeding programmes. Also called marker-assisted breeding.

Modern Biotechnology

Term used to distinguish newer applications of biotechnology, such as genetic engineering and cell fusion from more conventional methods such as breeding, or fermentation. (Definition adopted from the Cartagena Protocol on Biosafety).

Plant biotechnology

See Green Biotechnology

Precautionary principle

A rule that permits governments to impose restrictions on otherwise legitimate activities, if there is a perceived risk of damage to the environment or to human health. There is no agreed definition, hence its interpretation is disputed.

Resistance

The ability to withstand abiotic or biotic stress, or a toxic substance. Resistance, relative to susceptibility, is genetically determined. Forms of biotic resistance are insect resistance, bacterial resistance, and fungal resistance.

Subsidiarity

According to the principle of subsidiarity, within a system of governance, decisions should be taken at the lowest possible level, provided that goals such as safety and environmental protection are secured.

Subsistence farmers

Farmers who mostly grow food for home consumption, with any surplus typically being sold locally.

Transgene

An isolated gene sequence used to transform an organism. The transgene may have been derived from a different species than that of the recipient.

Transgenic

An organism that has had genes from another organism put into its genome through recombinant DNA techniques.

Transgenic event

Each time a transgene is introduced to a plant cell, the transgenic event created is slightly different, unfolding different properties, and perhaps regulatory consideration.

Tissue culture

The growth of cells, tissues or organs in a nutrient medium under sterile conditions. Plant tissue culture relies on the fact that all plant cells have the ability to generate a whole plant (totipotency). Single cells (protoplasts), pieces of leaves, or roots can often be used to generate a new plant on culture media, given the required nutrients and plant hormones.

References

Some References

Please note: Additional as well as issue-specific references will be provided in the Fact Sheets

- Alliance Sud (2005) Gentechnologie bekämpft den Hunger nicht. Global+, Dokument 8, www.alliancesud.ch/deutsch/files/D_PnDt8.pdf

- Bhagavan M. R. and Virgin I (2004) Agricultural Biotechnology in Developing Countries. A Briefing Paper for Sida. SEI Stockholm Environment Institute. ISBN 91 88714 92 6, http://63.166.104.204/sei/seipubs.nsf/Lookup/FBE9E0D1B9A1DC8D41256EFB004AC820/$file/Agricultural_Biotechlowres.pdf

- Cohen, J. I. (2005), Poorer nations turn to publicly developed GM crops. Nature Biotechnology 23 (No 1), 27–33, www.ifpri.org/pubs/articles/2005/naturebiotech.pdf

- DANIDA (2002) Assessment of Potentials and Constraints for Development and Use of Plant Biotechnology in Relation to Plant Breeding and Crop Production in Developing Countries. Royal Danish Ministry of Foreign Affairs, Copenhagen, Denmark. DANIDA Working Paper. www.icsu.org/1_icsuscience/GMO/html/DANIDA%20Biblio%20Entry.htm

- FAO (2004) The State of Food and Agriculture 2003-2004. Agricultural Biotechnology: Meeting the needs of the poor? www.fao.org/docrep/006/Y5160E/Y5160E00.HTM

- Inforesources (2006) Biotechnology and Food Security. Focus No 1/06 (e, f, sp) www.inforesources.ch/pdf/focus06_1_e.pdf

- James C. (2006) Global Status of Commercialized Biotech/GMCrops: 2006. ISAAA Brief No 35. International Service for the Acquisition of Agri-Biotech Applications, USA, www.isaaa.org

- Masood E. (2005) The GM debate – Who Decides? An analysis of decision-making about genetically modified crops in developing countries. Panos Report No 49. Published by the Panos Institute, UK. www.panos.org.uk/PDF/reports/gmdebate_report.pdf

- Nuffield Council on Bioethics (2004) The use of genetically modified crops in developing countries. Published by the Nuffield Council on Bioethics; ISBN 1 904384 07 2 www.nuffieldbioethics.org/go/ourwork/gmcrops/publication_313.html

- Omamo S. W. and Grebmer von K. (2005) Biotechnology, Agriculture, and Food Security in Southern Africa. Published by IFPRI Washington D.C., Food, Agriculture, and Natural Resources Policy Analysis Network. ISBN 0-89629-737-3, www.ifpri.org/pubs/books/oc46/oc46toc.pdf

- Persley G. J. (2003) New Genetics, Food and Agriculture: Scientific Discoveries – Societal Dilemmas. International Council for Science. ISBN 0-930357-57-4 www.icsu.org/2_resourcecentre

- Qaim M. and Matuschke I. (2005) Impacts of genetically modified crops in developing countries: a survey. Quarterly Journal of International Agriculture 44 (No 3), 207227

- Sanchez P. A. and Swaminathan M. S. (2005) Cutting World Hunger in Half. Science 307, 357–359

- Swiss Ethics Committee on Non-Human Gene technology (ECNH) (2005) Gene technology and Developing Countries. http://www.ekah.ch/buwal/eng/fachgebiete/fg_ekah/publikationen/broschueren/index.html

- Swissaid (2005) Position Paper 'Genetic Engineering in Agriculture'. www.swissaid.ch/news/e/documents/symposium_doku_e_000.pdf

- WFP Policy on Donations of Foods derived from Biotechnology (GM/ Biotech Foods) (2002). www.wfp.org/eb/docs/2002/wfp011823~2.pdf

- World Bank (2003) Biosafety Regulation: A review of International Approaches, Published by the Word Bank Agriculture & Rural Development Department, Report No. 26028. www.worldbank.org/reference/

Useful Resource Links

- Checkbiotech: Up-to-date news articles and information on agricultural biotechnology. www.checkbiotech.org

- Ethics. www.nuffieldbioethics.org

- FAO: Biotechnology in Food and Agriculture www.fao.org/biotech/index.asp

- Global Knowledge Center on Crop Biotechnology. www.isaaa.org/kc

- GreenFacts: Scientific Facts on Genetically Modified Crops www.greenfactsorg/gmo/index.htm

- SciDevNet: Dossier Agri-biotech. www.scidev.net/dossiers/index.cfm?fuseaction=dossierItem&Dossier=6

- UNEP-GEF:Biosafety Projects. www.scidev.net/dossiers/index.cfm?fuseaction=dossierItem&Dossier=6

Photographs on the front cover:

© IRRI 2003 / Ariel Javellana / Paniqui, Tarlac, Phillipines

© SDC / Katharina Jenny / Tissue Culture

Photographs per page:

2. © SDC / Katharina Jenny / Malawi

3. © IRRI 2006 / Aileen del Rosario / Victoria, Laguna, Philippines

4. © IRRI 2003 / Ariel Javellana / Paniqui, Tarlac, Philippines

5. © Felix Hintermann / La Esperanza, Intibucá, Honduras

6. © SDC /Andreas Gerrits / United Republic of Tanzania

7. © IRRI 2006 / Raymond Panaligan / Los Baños, Laguna, Philippines

8. © SDC / Katharina Jenny / Malawi

9. © IRRI 2006 / Raymond Panaligan / Los Baños, Laguna, Philippines

10. © SDC / Katharina Jenny / Niger

11. © SDC / Katharina Jenny / Malawi

Photograph on the back cover:

© IRRI 2003 / Ariel Javellana / Los Baños, Laguna, Philippines