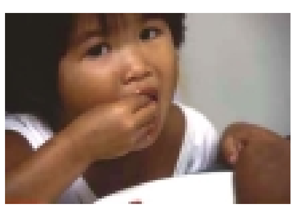
ISAAA Strategic Plan
2001-2005

Poverty and Technology



About the Cover

ISAAA helps to deliver the benefits of new agricultural biotechnologies to the poor in developing countries and paves the way for sustainable productivity and a more secure environment for present and future generations.

Poverty and Technology

The International Service for the Acquisition of Agri-biotech Applications (ISAAA) is a not-for-profit international organization cosponsored by public and private institutions that facilitates the transfer of agri-biotechnology applications – particularly private sector proprietary technology – from industrial to developing countries for their benefit.

The mission of ISAAA is to contribute to poverty alleviation by increasing crop productivity and income generation particularly for resource-poor farmers, and to bring about a safer environment and more sustainable agricultural development.

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POVERTY AND TECHNOLOGY

THE STRATEGY
OF THE INTERNATIONAL SERVICE
FOR THE ACQUISITION
OF AGRI-BIOTECH APPLICATIONS
2001-2005

Executive Summary

The International Service for the Acquisition of Agri-biotech Applications (ISAAA) is a not-for-profit organization that delivers the benefits of new agricultural biotechnologies to the poor in developing countries. Our strategy works not only to transfer these powerful technologies but also to establish an enabling environment for their safe and effective use. Established in 1991, ISAAA is co-sponsored by public and private institutions from around the world that share its vision of alleviating poverty through improved agricultural technologies.

The key elements of ISAAA's enhanced strategy are:

Priority Identification
ISAAA's demand driven program responds to the crop biotechnology needs and priorities identified by developing countries.

Technology Appraisal
ISAAA diligently works to identify, evaluate, and facilitate the acquisition of new crop biotechnology applications with benefits for resource-poor farmers.

Project Implementation
The implementation of ISAAA's portfolio of crop biotechnology projects is guided by the following:

- A potential for near term impact on food, feed, fiber crops, and forestry
- The selection of beneficial technologies from a variety of applications, including tissue culture, diagnostics, transgenic crops with specific traits, molecular markers, and genomics-derived applications
- A balanced portfolio of applications with input traits to control crop stresses and output traits to produce more nutritious food
- Applications that can contribute to a safer environment and more sustainable agriculture by decreasing dependency on water, pesticides, and fertilizers
- The development of a small number of global projects that can improve major staple food crops

Services for the Enabling Environment

ISAAA provides advice and services to assist in the development of an enabling environment for the safe and responsible use of crop biotechnologies in selected countries. These services include:

- Capacity building in a wide range of policy and technology aspects for policy makers and scientists through ISAAA's Fellowship Program and other activities.
- Guidance and training in such regulatory areas as biosafety, food safety, intellectual property rights, and the ecological management of transgenic crops.
- Commissioning and publishing independent ex-ante and ex-post impact assessment studies to document project outcomes.
- Through ISAAA's multi-media Global Knowledge Center on Crop Biotechnology, we consolidate and distribute current, authoritative knowledge about all aspects of biotechnology with implications for developing countries. ISAAA's new strategy builds upon its previous accomplishments by focusing even more on this crucial area of information, knowledge sharing, and public awareness.

ISAAA's mission is to contribute to poverty reduction through sustainable increases in crop productivity in the developing world. We are achieving this mission by facilitating the transfer of crop biotechnology applications to developing countries and by strengthening the capacity to evaluate, regulate, and deploy these new technologies. Over the past decade, ISAAA's emphasis has been on facilitating the transfer of proprietary technologies from the private sector in industrial countries to developing countries for the benefit of subsistence farmers and the poor. In our revised and enhanced strategy, ISAAA is strengthening this effort by increasing its emphasis on facilitating the sharing of technology and experience between developing countries for their mutual benefit. This strategy will be implemented through ISAAA's *Afri*Center and *SEAsia*Center.


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Introduction

ISAAA's strategy is designed to address the urgent food, feed, and fiber needs of today's world. At least 800 million people suffer from hunger and poverty worldwide, and their struggle becomes more difficult each year as the environmental degradation caused by pollution and unsustainable farming practices spreads. ISAAA believes that new crop biotechnologies have a crucial role to play in finding a solution to global poverty, and we are committed to their appropriate, safe, and equitable use. It is the world's poor who will benefit most from the increased yields, reduced pollution, and improved nutritional characteristics of new crop technologies, and ISAAA's award-winning, integrated technology transfer projects are demonstrating this today in developing countries. Our revised strategy builds upon these successes by giving greater emphasis to the sharing of information and knowledge gained from the experience of our partners in using technology to alleviate poverty.

CONTEXT

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Future Global Food Needs: The world's population will grow by about 73 million people every year from 2001 to 2020, with most of the growth in developing countries. Meeting the food needs of this expanding and increasingly urban population requires dramatic increases in agricultural productivity. World grain production will need to increase by 40%, roots and tubers by 58%, and livestock production must double to meet projected world food demand in 2020. These increases will have to be achieved through increased sustainable agricultural production per unit of land so that already degraded and diminishing natural resources can be conserved.

Present agricultural trends point to alarming future challenges. Yield increases for cereals in the major cropping systems are stagnant or declining. The intensification of agriculture and the reliance on irrigation and chemical inputs have led to environmental degradation, such as soil salinity and pesticide misuse problems. Other agricultural-associated practices, including deforestation, overgrazing, and overfishing also threaten the sustainable use of natural resources. In short, the amount of land and water available for agriculture continues to decline.

Furthermore, as countries achieved food security and the immediate threat of famines receded, national and international public investments in the rural sector and in science and technology declined—and they have not been replaced by private investments. And even the benefits of ***Green Revolution*** technologies were limited to favorable and irrigated environments. They have had little impact in rainfed and marginal areas where poverty is concentrated. New investments and new technologies are desperately needed.

Given present trends in population, food production, trade, and the environment, the necessary increases in production and income generation in rural areas will not be achieved simply by expanding cultivated land and using current technologies. While agricultural production must be intensified to meet projected demands for food, feed, and fiber, intensification strategies must also change to avoid adverse environmental impact and to reverse the effects of past practices.

Strategies to achieve the needed increases in food supply over the next 25 years include:

- Attaining sustainable productivity increases in food, feed, and fiber crops in both irrigated and rainfed areas
- Reducing chemical inputs of fertilizers and pesticides and replacing these with biologically based products

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- Integrating soil, water, and nutrient management
- Conserving agriculturally related biodiversity
- Improving the nutrition and productivity of livestock and controlling livestock diseases
- Achieving sustainable increases in fisheries and aquaculture production
- Increasing trade and competitiveness in global markets

THE CONTRIBUTIONS OF SCIENCE AND TECHNOLOGY TO POVERTY REDUCTION AND FOOD SECURITY

Science and technology have been the foundation of the social and economic gains made in agriculture over the past 30 years. Increases in global food production have more than kept pace with increases in population from 1960 to 2000. In this period, world cereal production doubled, per capita food production increased 37%, calories supplied increased 35%, and real food prices fell by almost 50%. Most of the productivity gains have been due to yield increases, particularly those resulting from the discovery of dwarfing and other useful genes in wheat and rice. These and other scientific discoveries, combined with a mix of supportive public policies and public and private investments in rural areas (particularly for irrigation, credit, and inputs), reduced the number of people living in poverty by half. These overall achievements, however, mask significant variations in agricultural performance across regions. Agricultural progress is especially evident in Asia, but food security in sub-Saharan Africa is particularly fragile.

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APPLICATIONS OF BIOTECHNOLOGY TO DEVELOPMENT GOALS


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The increasing use of new techniques to understand and modify the genetics of living organisms, and the ability to protect the intellectual property resulting from these discoveries, has led to enormous increased interest and investment in biotechnology. This has been accompanied, however, by increased concerns about the power of these technologies and the ethics and safety of their use.

Biotechnology applications are based on a suite of evolving technologies that stem from rapid, ongoing scientific discoveries about the structure and function of genes and their behavior in the environment. Several emerging economies, such as China, Mexico, and South Africa, are heavily investing in biotechnology in order to use these new developments in the biological sciences to reduce poverty, improve food security, conserve the environment, and improve trade competitiveness.

Modern biotechnology offers many advantages over traditional plant breeding. For example, it offers possible solutions to previously intractable problems and difficult targets such as drought tolerance. It also enables the development of new products and dramatically speeds up plant and animal breeding. The application of new biotechnologies will be one of the key means to achieve the goals of development strategies, but these strategies must be:

- directed at clearly defined targets that affect poverty reduction, food security, environmental conservation, and/or competitiveness;

- accompanied by political will, appropriate public policies, public and private investments in technology, and product development and delivery; and
- implemented under the auspices of regulatory frameworks that have the public's confidence.

Commercial Applications of Crop Biotechnology

New developments in agricultural biotechnology are being used to improve the productivity of crops. Primarily, this involves reducing yield losses due to biotic stresses and decreasing production costs via lower pesticide and herbicide use. Currently, these applications are mostly for crops grown in temperate zones.

Private industry has dominated biotechnology research, accounting for approximately 80% of all R&D. Over the past decade, the commercial cultivation of transgenic plant varieties became well established. In 2001, it is estimated that over 50 million hectares of land were planted with transgenic varieties of over 20 plant species, the most commercially important of which were cotton, corn, soybean, and rapeseed (James, 2001). The value of the global market in transgenic crops grew from US$1 million in 1995 to approximately US$3 billion in 2000.

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The traits these new commercial crop varieties contain include insect resistance (cotton, maize), herbicide resistance (corn, soybean, canola), and delayed fruit ripening (tomato). The benefits of these new crops are better weed and insect control, higher productivity, and more flexible crop management. These benefits accrue primarily to farmers and agribusinesses, although consumers also benefit from low cost food production. Health benefits for consumers are also emerging from new varieties of corn and rapeseed with modified oil content and reduced levels of potentially carcinogenic mycotoxins. The broader benefits to the environment and the community are improved food security and the reduced use of pesticides, which greatly contributes to more sustainable agriculture. Future scientific advances will likely result in more crops with more traits that directly benefit consumers, such as foods with improved nutritional quality.

Crop biotechnology applications can benefit both farmers and consumers in emerging economies since they are able to offer new solutions to such chronic problems as pests, weeds, diseases, drought, and soil salinity. The increased investments in consumer-oriented traits also hold great promise for malnourished people.

ISAAA seeks to contribute to reducing poverty in the developing world by identifying and matching specific agricultural problems with possible new biotechnology-based solutions.

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OVERVIEW OF THE ISAAA STRATEGY

The ISAAA strategy aims to deliver the benefits of new crop biotechnology applications to poor people in developing countries while also ensuring that an enabling environment exists for the safe and effective use of these new biotechnologies. The strategy consists of four key components: *priority identification, technology appraisal, project implementation, and services for the enabling environment.*

KEY COMPONENTS

PRIORITY IDENTIFICATION

Respond to the crop biotechnology needs and priorities identified by developing countries, particularly the needs of resource-poor farmers. This requires ISAAA to focus on a *demand driven program* that responds to needs identified by developing countries and identifies the priority areas where ISAAA can assist.


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TECHNOLOGY APPRAISAL

Identify, evaluate, and facilitate the acquisition of new crop biotechnology applications: These applications may be proprietary technologies developed by private sector companies in industrial economies with potential usefulness in developing countries. They may also come from the suite of crop biotechnology applications now in use in some emerging economies, such as China and South Africa, that have potential for wider application in the developing world. ISAAA will look for opportunities to facilitate the identification, sharing, and evaluation of specific new crop biotechnology applications that may address particular problems in developing countries.

PROJECT IMPLEMENTATION

Implement a portfolio of crop biotechnology projects that feature the following attributes:

- Crop biotechnology applications with a potential for *near term impact in food, feed, fiber crops, and forestry*, based on their performance elsewhere

- A range of applications to include *tissue culture, diagnostics, transgenic crops with specific traits, molecular markers* and *genomics-derived applications* that can enhance conventional plant breeding

- A balanced portfolio of projects featuring *input traits for the control of abiotic and biotic stresses and output traits to produce more nutritious food*

- Applications that *decrease dependency on principal external inputs—water, pesticides, and fertilizers*—and can thereby contribute to a safer environment and more sustainable agriculture

- Development of a small number of *global projects* that focus on improvements in *major staple food crops* with the potential to dramatically reduce poverty and malnutrition

SERVICES FOR THE ENABLING ENVIRONMENT

Provide advice and services to assist in the development of an *enabling environment to support the safe application of crop biotechnology* in particular countries. These services include:

- *Capacity Building* for policy makers and scientists from developing countries in a range of policy and technology aspects of crop biotechnology, accomplished through workshops, participation in networks, exchange visits, and internships facilitated through awarding scholarships from the *ISAAA Biotechnology Fellowship Program.*


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- *Regulatory Oversight:* Guidance and training in the establishment of transparent, science-based, decision making processes in regulatory areas that govern the safe use of new biotechnologies in crops. These areas include *biosafety, food safety, intellectual property rights, and the ecological management of transgenic crops.*

- *Impact Assessment*: Commissioning and publishing independent *ex-ante* and *ex-post impact assessment studies* to assess the likely impact of crop biotechnology applications on food, feed, and fiber production, environmentally sustainable agriculture, food security, and poverty reduction.

- *Information, Knowledge Sharing, and Public Awareness:* The consolidation and distribution of current and authoritative knowledge about all aspects of crop biotechnology with implications for developing countries. These activities will be facilitated through ISAAA's multi-media *Global Knowledge Center on Crop Biotechnology,* with nodes (Biotechnology Information Centers (BICs)) in key national programs in Asia, Africa, and Latin America. This thrust is designed to share knowledge and experience with those interested in assessing the current and potential contributions of crop biotechnology to food, feed, and fiber security, a safer environment, and more sustainable agriculture.


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The strategy will be implemented through ISAAA's *Afri*Center and *SEAsia*Center, as well as through a small number of global initiatives.

Emerging Opportunities

There are some emerging policy and scientific issues that influence access to new technologies and their safe and effective use in developing countries. These issues are:

- Information and knowledge sharing
- Intellectual property management
- Impact assessment
- Plant genomics
- South-South sharing of technology

ISAAA is developing global initiatives in a few of these key areas to complement its Asian and African programs and these are described below.

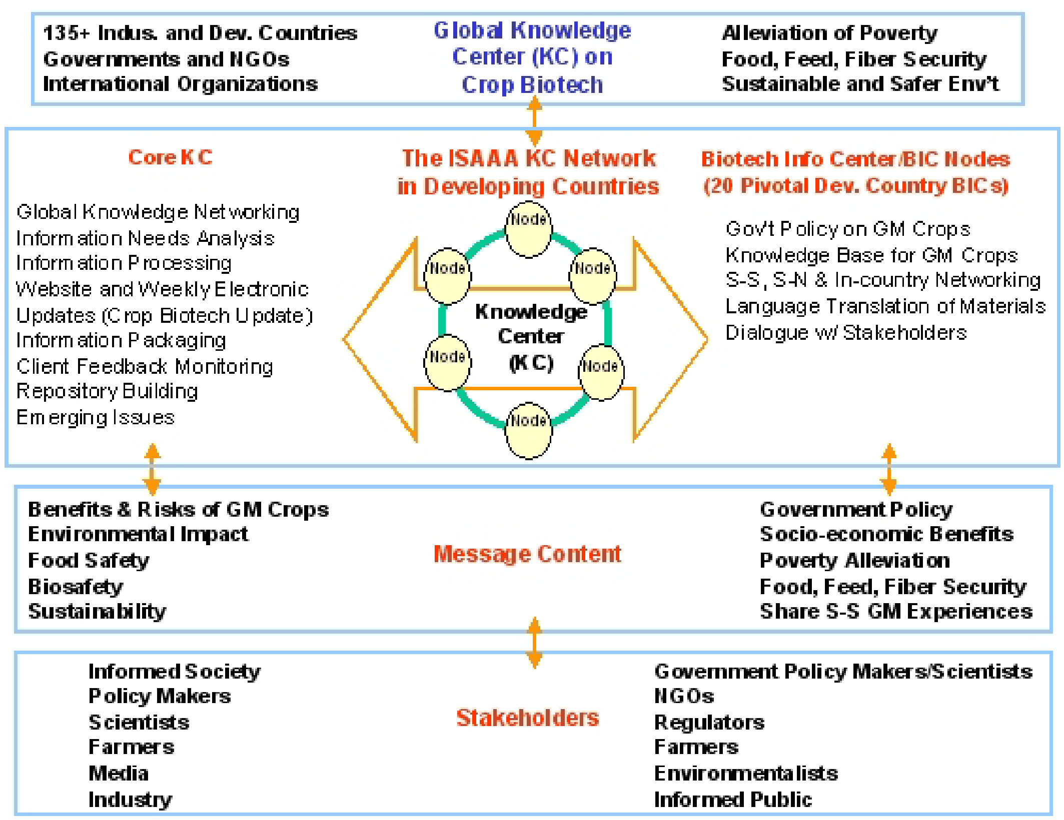
Global Knowledge Center on Crop Biotechnology

The lack of current authoritative information and knowledge on crop biotechnology is a major constraint, especially in developing countries where policy makers need to make decisions about the appropriateness of particular new technologies and their regulatory requirements. Recognizing that access to authoritative knowledge on crop biotechnology is a prerequisite to sound decision making, ISAAA, in association with CABI Publishing, has initiated a global effort to collect, analyze, and distribute authoritative information and knowledge on crop biotechnology in relation to developing countries. Access to authoritative information is particularly critical for emerging economies, several of whom are in the process of making critical decisions about the development and deployment of biotechnology products, especially transgenic crops.

The ISAAA Knowledge Center initiative arose in response to a request from senior policy makers and national program leaders in Southeast Asia. The principal goal is to share knowledge on all aspects of crop biotechnology for all stakeholders, including consumers, farmers, policy makers, scientists, and the media in developing countries. The initiative also aims to build capacity in national programs by establishing a network of Biotechnology Information Centers (BICs) to facilitate sound decision-making in all aspects relating to the safe use of these crops and their potential contribution to food security, poverty reduction, and environmental conservation.

The principal thrust of the initiative is the establishment of a Global Knowledge Center on Crop Biotechnology to collect and distribute an authoritative and well-documented information and knowledge base on all aspects of crop biotechnology. The Knowledge Center (KC) was established in late 2000 and is co-located with ISAAA's *SEAsia*Center in the Philippines. The Knowledge Center is specifically tailored to meet the needs of developing countries, and supports a Global Information Network with nodes (BICs) at several national biotechnology information centers in Asia, Africa, and Latin America.

The Global Knowledge Center on Crop Biotechnology.



An innovative web site, Crop Biotech Net, has been established. In collaboration with CAB International, a weekly electronic newsletter, “Crop Biotech Update”, has been providing regular updates and briefs on crop biotechnology since January 2001. A set of pocket knowledge sheets has been prepared and translated into 13 languages, including English, Mandarin, Hindi, Bahasa Indonesia, Filipino, Thai, Swahili, French, Arabic, Afrikaan, Portuguese, Vietnamese, and Spanish. The web site of the Global Knowledge Center on Crop Biotechnology is located at www.isaaa.org/kc.

ISAAA’s commitment to sharing knowledge is evidenced in its well-received series of *ISAAA Briefs* and *The Annual Global Review of Commercialized Transgenic Crops* conducted by ISAAA annually since 1996. The latter has become accepted internationally as the authoritative reference on the global deployment of commercialized genetically modified (GM) crops, and these valuable reviews will continue to be published and widely distributed by ISAAA to monitor the global deployment of GM crops in the first decade of the 21st century.

Other complementary thrusts of the ISAAA’s Global Knowledge Center on Crop Biotechnology initiative include:

- Participation by senior statesmen in science and socio-economics in public biotechnology forums in developing countries, and consultations with senior policy makers responsible for biotechnology;
- Study tours for policy makers and scientists from developing countries;
- Facilitating the sharing of South-South experiences on transgenic crops. This is an expanding area as experience with these crops grows in countries such as China, Argentina, and South Africa that have new transgenic crop varieties under commercial cultivation.

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Impact Assessments

Impact assessment of crop biotechnology applications in Southeast Asia and Africa
ISAAA will commission *independent ex ante and ex post impact assessment* studies on crop biotechnology applications in Southeast Asia and Africa. Impact assessments will be undertaken on ISAAA's ongoing technology transfer projects in South East Asia (e.g., the regional papaya biotechnology project, the sweet potato weevil project in Vietnam, and the *Bt* corn project in the Philippines). Ex ante and ex post impact assessment studies will also be commissioned on ISAAA's African projects. These studies will be shared with a wider audience through the Global Knowledge Center on Crop Biotechnology.

Assessment of the impact of Bt *cotton in emerging economies*


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Insect resistant cotton containing genes from *Bacillus thuringiensis* (*Bt*) is grown in four emerging economies that are commercializing transgenic crops: China, Mexico, Argentina, and South Africa (James 2001). China is growing by far the largest area of *Bt* cotton (an estimated 1.5 million ha), with approximately 5 million small farmers reported to be deriving many significant social, environmental, and economic benefits. These benefits include higher productivity, significantly higher net returns per hectare, decreased health hazards to farmers, and a safer environment due to reduced applications of insecticides.

Studies are being undertaken by several organizations in China to assess the benefits of *Bt* cotton, including its impact on the alleviation of poverty. These impact assessment studies need to be extended over multiple years and should also include impact assessments from other emerging economies where *Bt* cotton is being grown commercially. ISAAA plans to facilitate the research, publication, and distribution of impact assessments about the socio-economic, environmental, and human health effects of *Bt* cotton cultivation in China and other emerging economies. This activity will involve collaboration with institutions with expertise in socio-economic and environmental impact assessment techniques in both industrial and developing countries.

Plant genomics

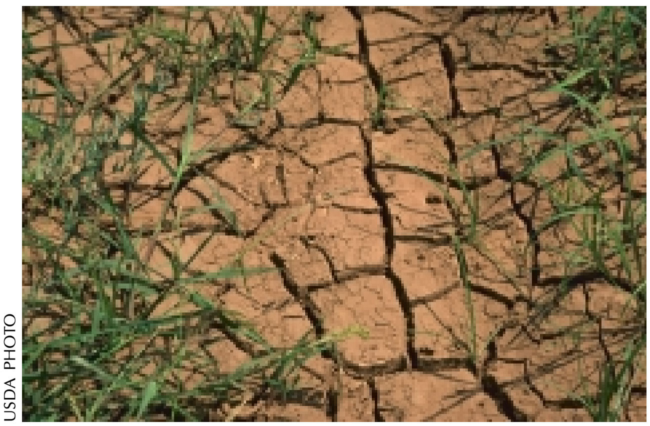
Genomics is the determination of a DNA sequence and the identification of the location and function of all the genes contained in the *genome* of an organism. The advent of large-scale sequencing of entire genomes of organisms as diverse as bacteria, fungi, plants, and animals, is leading to the identification of the complete complement of genes found in many different organisms. This new knowledge is likely to change the future of breeding for improved strains of crops, livestock, fish, and tree species.

The present major technical limitation to improving agriculture through the application of recombinant DNA technology is insufficient understanding of exactly which genes control agriculturally important traits and how they do so. Accordingly, linking new understandings of gene function with breeding and genetic resources conservation programs is becoming more and more important.

Early results from plant genome projects are showing that many traits are *conserved* (shared) within and even between species. Thus the same gene(s) (DNA sequences) may confer the same trait in different species. A gene for drought tolerance in millet may also confer drought tolerance if transferred to maize. These advances in genomics should lead to the identification of useful traits to enhance future crops.

Functional genomics for trait discovery

Although much of the discussion about molecular biology today is focused on the opportunities and risks associated with transgenics, the scientific discoveries in genomics are bringing new tools to assist plant breeders in identifying and transfering genes through conventional breeding approaches. In many environments, future gains in productivity will depend upon the manipulation of complex traits, such as drought or heat tolerance. These are often difficult to identify and utilize in a conventional breeding program without the additional help of current genomic technologies. In the near future, plant genomic projects will help solve presently intractable problems in crop production by driving trait discovery and crop improvement.



USDA PHOTO

ISAAA will monitor new developments in genomics and assess their implications for crop improvement in the major tropical food crops. ISAAA will also initiate a *fellowships program in genomics* to enable scientists from developing countries with strong plant breeding programs to become familiar with the technology and assess its potential usefulness.

Intellectual property and technology transfer

Most useful biotechnology applications are based on proprietary technologies. Consequently, intellectual property management is essential for successful crop biotechnology transfer and development programs. Indeed, as a result of the following factors, intellectual property has become an even more important issue over the past several years:

- International agreements, particularly the trade related intellectual property provisions (TRIPs) of the World Trade Organization;
- The expanding global trade of agricultural products;
- The recognition of the value of biological diversity and the associated Convention on Biological Diversity (CBD);
- Significant investments in biotechnology in both developing and industrial countries.

A recent review of ISAAA's Intellectual Property and Technology Transfer Initiative (IP/TT) identified the future needs and opportunities in this area for ISAAA's partner countries. The review team was impressed by the services that ISAAA provides with its practical approach to capacity building for personnel in the developing world, especially through internships. The review team recommended that ISAAA should approve the request of its partner countries to shift the central location of its IP/TT activities to Southeast Asia and develop an IP network in the region. This is consistent with ISAAA's commitment to maximizing the deployment of its resources in developing countries. Furthermore, by expanding present ISAAA IP/TT capacity building and management services in Southeast Asia and Africa, ISAAA can provide important contributions to the IP human resource development initiatives that national programs must invest in over the next five years. ISAAA's unique experience in negotiating for the donation of proprietary biotechnology applications and the lessons learned from these experiences over the past decade can be used as case studies. Similarly, ISAAA's training activities in IP/TT can contribute to building sustainable capacity that can help meet the growing demands and changing IP/TT needs of the future in these countries.

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IMPLEMENTATION STRATEGIES

THE AFRICAN PROGRAM

Agriculture is not only the primary source of food in Africa, it is also the principal means of income and livelihood for 70% of its people. African women produce 70 to 80% of the food compared with 65% in Asia and 45% in Latin America and the Caribbean. Currently, the prospects for agriculture are threatened in Africa, with approximately 80% of the land in Africa endangered by degradation and 2 million hectares of forest lost annually to shifting cultivation.

The International Food Policy Research Institute's (IFPRI) 2001 projections indicate that whereas overall food production has the capacity to grow significantly to meet global food needs in 2025, the problem of food security will continue to be acute in Sub-Saharan Africa. The population of Africa is expected to continue to grow at about 2.8 percent per year, while economic growth lags at 1 percent and agricultural investments continue to decline. From the 1970s to the 1990s, per capita food production in Africa has actually declined by about 2% per year.

African leaders and the international development community have set a goal to increase future agricultural production across Africa by at least 4% per annum. This growth rate is only feasible if agriculture is accorded higher priority by national governments and by bilateral and multilateral development agencies, and these increased investments must be supported by appropriate policies. Furthermore, achieving annual sustained growth of 4% will be impossible without significantly increasing crop productivity through higher yielding, more nutritious crops.

ISAAA's Future African Strategy

There are five key elements in ISAAA's evolving strategy in Africa. These are:

- Multiplying impact through regional projects
- Improving crops through enhanced nutrition, quality, and other traits
- Strengthening capacity for crop biotechnology in Africa
- Strengthening strategic alliances
- Facilitating international representation of African interests.

Multiplying impact through regional projects

ISAAA plans to extend its current successful portfolio of projects in Kenya (See boxed section on page 30) to neighboring countries with similar crop production constraints, particularly Uganda and Tanzania. An estimated 40 million people live below the poverty line in these three countries.

In the *banana project*, the demand in Kenya alone is for 30 million tissue culture plants. Bananas are a major food staple and a source of income for over 20 million farmers in Kenya, Uganda, and Tanzania. ISAAA will facilitate the large-scale adoption of this new technology for banana production by collaborating with organizations that have experience and capacity in extension, micro-credit, and marketing. ISAAA has already established micro-credit schemes with NGOs and has also initiated pilot-scale activities that will be extended by partner organizations and funded independently by international development agencies.

Tree biotechnology project: It is proposed to extend the multiple-purpose tree project from Kenya to neighboring countries to provide wood products urgently needed for fuel, fencing posts and timber for building.

Improving crops, through enhanced nutrition, quality and other traits

The following improved traits will be explored in staple food crops for Africa:

- *Banana* plants that can be enhanced through the incorporation of transgenes that confer resistance to important diseases such as Black Sigatoka and Fusarium wilt and/or through the incorporation of output traits that confer improved nutritional qualities and remedies for micro-nutrient and vitamin deficiencies.


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- *Maize* seeds with enhanced resistance to maize streak virus—an approach made possible through molecular marker breeding—can be further improved by incorporating traits for better quality protein via conventional breeding or by incorporating transgenes to provide other improved traits. The latter may include such traits as a remedy for amino acid deficiencies (e.g., high lysine), more nutritious oils, better fatty acid profiles, better weed control, and tolerance to drought and salinity.

- *Sweet potatoes* that are more resistant to sweet potato feathery mottle virus (SPFMV) can be enhanced with transgenes for better resistance to other pests and diseases and/or improved quality. These may include traits such as *Bt* genes for weevil resistance; starch with improved structure, productivity, and digestibility; beta carotene enrichment to correct Vitamin A deficiency; and enhanced iron as a remedy for anemia.

- *New opportunities* for increasing the productivity and nutrition of other staple crops in Africa, such as cassava and rice, are likely to become available in the next 5 years. ISAAA will evaluate new technologies as they become available for their likely utility in African farming systems.

Strengthening capacity for crop biotechnology in Africa

Investing in human capital and institution building is a prerequisite for building national capacity in crop biotechnology, and ISAAA will strengthen its activities in capacity building through the following activities:

- Assisting with the development, promulgation, and implementation of regulatory systems for living modified organisms (LMOs) and their products that are in harmony with the Cartagena Protocol on Biosafety and the best international practices and standards;

- Establishing a node of the Global Network of the Crop Biotechnology Knowledge Center, in association with the African Biotechnology Stakeholders Forum and other organizations in South Africa, Egypt, and pivotal countries in Francophone Africa. ISAAA's *Afri*Center will distribute materials to the principal African institutions, policy makers, scientists, and interested parties. Its primary purpose is to facilitate a knowledge-based, better informed public debate on issues related to transgenic crops and genetically modified foods;

- Facilitating capacity building in small indigenous private sector enterprises that are vital for generating and effectively distributing quality-controlled products, particularly seeds, tissue cultured plants, and other micro-propagated crops;

- Advocating to bilateral and multilateral donors the need to build a national knowledge base in developing countries and a capacity in all areas of crop biotechnology;

- Supporting capacity building through ISAAA's fellowships and training program in crop biotechnology;

- Providing guidance and training in the area of intellectual property rights management.

Strengthening strategic alliances

The ISAAA *Afri*Center will strengthen its strategic alliance with such groups as:

- *The African Biotechnology Stakeholders Forum (ABSF)* which consists of members from eleven African countries and brings together politicians, policy makers, scientists, farmers, NGOs, the public, and the press to represent the biotechnology interests of the region.

- *South Africa*, whose leadership and political will when it comes to biotechnology were demonstrated when it became the first country in Africa to commercialize *Bt* corn (yellow for feed and white for food), *Bt* and herbicide tolerant cotton, and herbicide tolerant soybean. South Africa is freely donating and sharing biotechnology applications with Kenya in the present banana and multi-purpose tree projects.

- *Egypt*, which also has strong capacity in crop biotechnology, including crop transformation technology;

- *Rockefeller Foundation*, whose new biotechnology program focuses on building capacity in crop biotechnology in Sub-Sahara Africa and on important traits such as drought tolerance;

- *International agricultural research centers* with crop biotechnology activities and policy and research management programs relevant to African farming systems;

- *Universities* internationally and in Africa, particularly by strengthening existing arrangements with Cape Town and Durban universities;

- *Private sector companies*, ranging from small indigenous African corporations to large multinational corporations, which are a principal source of proprietary biotechnology applications;

- Other like-minded institutions that are engaged in various aspects of crop biotechnology development.

Facilitating the international representation of African interests

The ISAAA *Afri*Center will continue its activities in international forums to help ensure that Africans are engaged, informed, and able to decide on all issues related to biotechnology in Africa. Many international agreements, including those related to the World Trade Organization and the International Biosafety Protocol of the Convention on Biodiversity, will influence activities related to crop biotechnology in Africa. ISAAA will continue to provide advice and background information upon request, with the understanding that the governments of the sovereign states of Africa will be directly involved in the negotiations and decision-making.

ISAAA's Current African Project Portfolio

The ISAAA *Afri*Center was established in 1994 in Kenya. It actively supports three projects: the introduction and farm-level evaluation of new biotechnologies for banana, fast growing multi-purpose trees, and sweet potato. These projects are conducted in partnership with the Kenyan Agricultural Research Institute (KARI), farmer cooperatives, local private companies, and collaborators in Kenya, South Africa, Tanzania, and Uganda.


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Banana project: The KARI/ISAAA banana project is delivering clean, tissue cultured banana plantlets to farmers. These plantlets can more than double production and significantly enhance the income of resource-poor farmers, many of whom are women. It is contributing directly to the reduction of poverty in rural areas. In recognition of its achievements, the banana project was awarded first prize for its outstanding contributions to research and development in a 2000 medal award competition sponsored by the Global Development Network (GDN), an initiative of the World Bank and the Government of Japan.

Multi-purpose tree project: Another ISAAA project in Africa focuses on the multiple-purpose trees Eucalyptus, Grevilliea, Acacia, and *Mellia volkensii*. It seeks to provide faster growing trees that can increase the supply of urgently needed wood for fuel, fencing, and animal feed in deforested rural areas. Some of the new hybrid Eucalyptus clones grow three times as fast as conventional clones. Mondi Forests of South Africa shared the improved tree germplasm and technology for propagation.

Sweet potato project: The Monsanto-assisted project seeks to introduce and evaluate sweet potato with introduced resistance to one of the most important virus diseases in East Africa: Sweet Potato Feathery Mottle Virus. The National Biosafety Committee of Kenya approved the introduction and field evaluation of transgenic sweet potato lines, and the first field trials were planted with transgenic sweet potato in several locations in Kenya in December 2000. This was the first field trial of any transgenic crop in Kenya. ❑

The Asian Program


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The development challenges in Asia are equally formidable as those in Africa but differ in important ways. ISAAA's program in Asia is therefore tailored to meet the needs of ISAAA's partners and designed to meet the region's unique challenges.

Asia represents a formidable challenge because:

- Asia will have the highest absolute increase in population in the next 25-50 years;
- Asia will have to increase cereal production by at least 40% over the next 25 years to meet its needs for food, livestock feed, and fiber;
- Production of all other major food products will need to keep pace with population growth and increased demand;
- Asia's per capita agricultural land will continue to decrease rapidly;
- Land degradation will continue, with increasing problems of salinity and deforestation;
- Water scarcity will become acute and productivity increases will need to be achieved with less land and less water;
- Yield plateaus/yield declines will continue to occur in some of Asia's most productive lands.

Agriculture will continue to play a central role as Asia pursues the complementary goals of poverty reduction, sustainable food security, environmental conservation, and increasing trade competitiveness. New technologies, including crop biotechnology, will be essential to meet these challenges. The prospects for their utilization are particularly promising, since Asia's high priority development needs and existing biotechnology potential can intersect to make a difference in the lives of its 700 million rural poor.

The overall goal of ISAAA's crop biotechnology program in Asia is to help reduce rural poverty and ensure food security. This is being achieved by developing the necessary national and regional capacities to acquire, develop, and safely deploy important crop-biotechnology applications and products. These respond to the high-priority needs of the region's countries and focus on delivering benefits to resource-poor and small-scale farmers. ISAAA's program is implemented through a carefully focused and complementary set of projects and associated initiatives (See boxed section on page 39).

ISAAA's *SEAsia*Center was established in January 1998. The five partner countries are Indonesia, Malaysia, Philippines, Thailand, and Vietnam. The present portfolio of projects is aimed at developing capacity and facilitating the acquisition, transfer, and adoption of key crop-biotechnology applications that meet priority needs in these countries. ISAAA is also expanding its links with China and India on selected activities, particularly the sharing of information and experiences with crop biotechnology applications through the Crop Biotechnology Knowledge Center and its network of Biotechnology Information Centers (BICs) in pivotal Asian countries.

Since the establishment of ISAAA's SEAsia Center, ISAAA has also pursued three complementary initiatives that address constraints in the enabling environment. These seek to overcome the most significant immediate constraints to the introduction and use of important biotechnology applications. The three initiatives focus on:

- Adoption of effective biosafety regulatory systems
- Management of intellectual property rights
- Enhancing public awareness of the applications of agricultural biotechnology


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The ISAAA fellowship program is used in a flexible manner to award fellowships to national scientists in order to build capacity in the different aspects of biotechnology that need strengthening. ISAAA provides training in its partner countries at the national level and collectively at the regional level. Training at the regional level allows limited biotechnology resources in Southeast Asia to be utilized most effectively and also facilitates a common understanding of constraints and the harmonization of regional guidelines to manage and deploy crop biotechnology products.

ISAAA's Future Asian Strategy

In addition to completing the implementation of the current portfolio of projects, ISAAA plans to strengthen its program in Asia in four areas:

- Strengthening the activities of the Global Knowledge Center on Crop Biotechnology and its network of BICs in pivotal developing countries in Asia, Africa, and Latin America
- Broadening the portfolio of technology transfer projects
- Biosafety
- Food Safety

Strengthening the activities of the Global Knowledge Center on Crop Biotechnology and its network of BICs

ISAAA has an on-going three-thrust program to document, consolidate, and disseminate authoritative information and knowledge about GM crops and biotechnology to developing countries worldwide.

- The first element of the program, which is the heart of the system, is the Global Knowledge Center (KC) on Crop Biotechnology. Co-located at ISAAA's *SEAsia*Center in the Philippines, the Knowledge Center has already accomplished several important activities. Multi-media approaches for various stakeholders have been developed, including a well patronized web site and a broad range of publications, the most popular of which has been the Pocket K (Knowledge) series, available in thirteen of the principal languages of the South. Workshops have been conducted on knowledge networking and public awareness regarding biotechnology issues, and we have quickly provided the scanning, analysis, and packaging of information to meet specific client needs. Complementary activities include public biotechnology forums, study tours, and the sharing of South-South experiences with GM crops. The rationale underpinning the establishment of the KC was to overcome the lack of current authoritative knowledge on genetically modified crops and biotechnology in general. It caters to a broad range of stakeholders

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including politicians, policy makers, media, scientists, environmentalists, regulators, lawyers, non-government organizations, and other interest groups.

- The second element is an international network, developed in conjunction with the KC that regularly distributes information electronically and through hard copy to recipients worldwide. One of the most popular is the weekly “CropBiotech Update,” which highlights major current developments on crop biotechnology in regards to its policy and scientific implications for developing countries. Partner countries are encouraged to translate the “CropBiotech Update” into local languages to allow for a broader sharing of the information at the grass root level. The Update distributes breaking news and responses from authoritative sources, providing these countries with timely notification of the potential implications of new developments.

- The third element is the establishment of a network of nodes (Biotechnology Information Centers or BICs) in key developing countries in Asia, Latin America, and Africa. The long-term goal is for the Knowledge Center to have at least 20 nodes forming a global network in selected key developing countries. The BICs work closely with the Knowledge Center and respond to national information needs concerning crop biotechnology. Center clients, which include politicians, policy makers, the media, NGOs, special interest groups, and the public at large, are provided with focused information on agri-biotech activities and products as well as authoritative responses to emerging issues and policy concerns. In the long term the BICs serve the very important function of creating a sustainable and credible national knowledge base. It is composed of a respected support and advisory group for crop biotechnology known to influential opinion makers and policy makers in the national programs.

ISAAA's Vision of a Global Network of 20 Biotechnology Information Centers in the Developing World.

Broadening the portfolio of technology transfer projects

The emphasis in the current projects is on "input" or agronomic traits. Given that quality and nutritional traits are likely to become more accessible over the next five years, the portfolio of projects will be broadened to balance input and output traits addressing priority problems. The feasibility of the following potential projects is being explored:

- Quality protein maize with *Bt* resistance for the control of the Asiatic corn borer in open pollinated white maize varieties used as food by small-scale, resource-poor farmers in Indonesia, Vietnam, and the Philippines

- Enhancement of protein quality in potato and sweet potato in Vietnam
- Soybean improvement for insect (pod borer) resistance in soybean in Indonesia

ISAAA will also continue to monitor new developments in Asian agriculture and in emerging technologies so that it can quickly respond to new opportunities in an environment where both needs and solutions are likely to change rapidly.

The Biosafety Initiative

ISAAA will continue to take an active role in supporting national capacities in biosafety. The region's needs continue to evolve, and ISAAA will also assess how the Cartagena protocol on biosafety will be implemented effectively in its partner countries. The environmental management of new crop varieties to ensure the effective and durable deployment of novel resistance genes is also a concern. The following complementary activities will be explored and projects initiated as appropriate in support of these objectives:

- Workshops and fellowships/internships to enhance national capacity

- Management of *Bt* resistance in cotton and corn
  There is an urgent need to develop management practices to optimize the durability of resistance genes in *Bt* crops in tropical agro-ecosystems on small farms. The spatial distribution of the transgenic crops and mixed cropping systems is very different from regions where transgenic crops are grown as monocultures over extensive areas. ISAAA will bring together the best available knowledge on tropical insect resistance management in commercial transgenic crops and their impact on the environment. We will also continue to identify gaps that need to be addressed through research.

- Harmonizing biosafety standards and practices
  With the Cartagena Biosafety Protocol now in place, operational and implementation guidelines for individual countries must be developed. A common understanding of requisite biosafety guidelines, standards, and procedures is necessary to facilitate the safe movement of biotechnology products among countries. Harmonizing biosafety standards among Asian countries remains a priority, and ISAAA will work with regional agencies and organizations to facilitate regional harmonization.

Food safety initiative

ISAAA will expand its current food safety initiative by increasingly emphasizing capacity building for regulators in national programs and by communicating authoritative information on food safety to the general public through these national programs. This is a timely initiative, for consumers in Asia are becoming more aware of genetically modified crops and of food products derived from them. Such products are now available in many Asian countries, either as imports or as derived from domestically grown transgenic crops. Given its experience in this area, ISAAA believes that the initiative will contribute in important ways to an on-going dialogue about the safety of genetically modified foods.

ISAAA's Current Asian Project Portfolio

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The Papaya Biotechnology Regional Network for South East Asia: Papaya is very important to poor farmers and consumers in Southeast Asia, but two major constraints limit its production and availability: papaya ringspot virus and significant post-harvest losses.

ISAAA established a ***Papaya Biotechnology Regional Network for Southeast Asia*** to address these constraints through the partnerships and collective efforts of five target countries-Indonesia, Malaysia, Thailand, The Philippines, and Vietnam-and two private sector companies-Monsanto and Syngenta. ISAAA successfully brokered from these companies the donation of biotechnology applications that confer resistance to papaya ring spot virus and reduce post harvest losses. The impact of the transfer of these proprietary technologies has been greatly multiplied through the Network's inter-country technology transfer and training within Southeast Asia. Significant progress in capacity building, product development, and evaluation has already been accomplished.

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Introduction and Field Testing of Insect Resistant Corn in the Philippines: The evaluation of Bt corn for resistance to the Asiatic corn borer-the very first field trial of a transgenic crop in the Philippines-was successfully completed in March 2000. This first field trial was a pilot activity that allowed the Philippines' new biosafety regulations for environmental release of transgenic crops to be tested operationally for the first time. It also provided the first opportunity for the Philippine public, particularly farmers, to observe directly the potential value of a new biotechnology application that could significantly contribute to food security and a safer environment. After significant biosafety, legal, political, and public acceptance issues were addressed, multi-site trials began in 2001.

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Development and Transfer of Insect Resistant Sweet Potatoes in Vietnam: After rice and corn, sweet potato is the third most important crop in Vietnam. It is the most important root crop, however, in terms of area, production, and consumption. High in calories and rich in vitamins and minerals, sweet potato is a nutritious staple food grown by resource-poor farmers in every region of the country. Yields range from 6 to 9 tons per hectare, only half of the world average. The sweet potato weevil is the major production constraint, decreasing production by an estimated 57 to 77%. Unfortunately, Vietnamese farmers currently have no way to control the weevil.

ISAAA brokered an agreement with Syngenta, which agreed to donate *Bt* endotoxin genes and to train Vietnamese scientists to utilize them. ISAAA fellowships supported Vietnamese scientists, who were trained in the transformation systems for sweet potato, and an operational system is now in place and being implemented in Vietnam. Promising *Bt* strains with insecticidal activity against the sweet potato weevil have been identified, and the resistance genes are being isolated and cloned. After having received training through ISAAA, the Vietnamese scientists will conduct transformations of the major cultivars of sweet potato in their country. ❑

Global Projects

In its new strategy ISAAA also intends to look for opportunities to develop a small number of global projects that focus on improvements in major staple food crops and have the potential to greatly reduce poverty and malnutrition. Initially this may be accomplished by linking and expanding current projects in the

African and Asian portfolios, and expanding these by the evaluation of new traits of common interest across the continents. Opportunities being explored are:

- Banana, with disease resistance and delayed ripening
- Maize, with improved protein quality
- Sweet potato, with disease and insect resistance.

CONCLUSION

Operationally, ISAAA is becoming an increasingly decentralized organization, with autonomous but interlinked programs in Africa and Asia. These implement national and regional projects that will be complemented by global projects on major food crops where constraints and desirable traits are shared across continents. To strengthen the enabling environment for the safe and effective use of crop biotechnology, ISAAA is also implementing through its two centers and worldwide partners a number of key global initiatives: biosafety, food safety, intellectual property management, impact assessment and the Global Knowledge Center on Crop Biotechnology with its network of BICs in Asia, Africa and Latin America. ISAAA believes that the well-targeted use of crop biotechnology is a crucial, necessary element for reducing poverty and improving food security in the developing world. This new, enhanced strategy for ISAAA will allow it and its partners to work more effectively to reach this urgent goal.

Further Information

ADB (2001). Agricultural Biotechnology, Poverty Reduction and Food Security. Asian Development Bank: Manila, Philippines.

James, C. (2001). "The activities of the International Service for the Acquisition of Agri-biotech Applications (ISAAA) in crop biotechnology transfer", Journal of the Science of Food and Agriculture, 81: 813-821.

James, C. (2001). Global Review of Commercialized Transgenic Crops: 2000. ISAAA Briefs 23, ISAAA: Ithaca, NY.

James, C. (2001). Global Review of Commercialized Transgenic Crops: 2001. ISAAA Briefs 24: Preview, ISAAA: Ithaca, NY.

Lipton, M. (1999). Crawford Lecture. CGIAR/World Bank: Washington, DC.

Persley, G.J., and L.R. MacIntyre (eds) (2001). Agricultural Biotechnology: Country Case Studies-A Decade of Development, CAB Publishing, Wallingford, U.K.

Pinstrup-Andersen, P and M. Cohen. (2000). "Modern biotechnology for food and agriculture: risks and opportunities for the poor", in Persley, G.J. and M.M. Lantin, (eds), Agricultural Biotechnology and the Poor. Consultative Group on International Agricultural Research: Washington, DC.

Pinstrup-Andersen, P., R. Pandya-Lorch, and M.W. Rosegrant. (1999). World Food Prospects: Critical Issues for the Early Twenty First Century, International Food Policy Research Institute: Washington, DC.

Serageldin, I. and G.J. Persley. (2000). Promethean Science: Agricultural Biotechnology, the Environment and the Poor. Consultative Group on International Agricultural Research: Washington, DC.

UNDP (2001). Human Development Report 2001: Making New Technologies Work for Human Development, United Nations Development Programme: New York, NY.

World Bank (2000). World Development Report 2000/2001: Attacking Poverty, World Bank: Washington, DC.

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www.agbiotechnet.com

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