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Chapter 1 : Biotechnology: Putting an end to world hunger

the subcommittee will look at the role biotechnology can play in combating poverty, hunger and environmental degradation in developing countries. Our first witness will be the Honorable David Sandalow, Assistant Secretary of.

The hearing, chaired by Nebraska Senator Chuck Hagel, focused on the role of biotechnology in combating poverty and hunger in developing countries. Senator Hagel, members of the subcommittee, and others in attendance, thank you for the invitation to appear before the Subcommittee on International Economic Policy, Export and Trade Promotion. I am Roger N. The Danforth Center was established in as an independent, not for profit institution, formatted on the model of the great independent biomedical research institutes in the US The goal of the Danforth Center is the discovery of new knowledge in plant biology and applications of that knowledge to develop more sustainable agriculture, to improve human nutrition and human health, and to encourage commercial development of research discoveries. This effort includes training scientists in the development of intellectual and technical capacities that are relevant to their home countries in the areas of plant science and biotechnology. The website of the Center, www. I welcome the opportunity to present testimony on the importance of research on plant sciences, agriculture, food and nutrition. The particular focus of my remarks today relate to the importance of research for the benefit of the poor in developing countries and as an essential step in fighting hunger and disease. Few of us deny that there are tremendous needs around the world for adequate amounts of nutritious foods. Adequate food and nutrition are essential to ensure the physical and intellectual growth and development of children that leads to healthy and productive adults. For example, it in known that: It is estimated that million people currently are undernourished or malnourished worldwide. Yet, there is limited land on which to produce food without further destroying the important forests and wilderness areas that produce life-giving oxygen, cleanse our air, protect and sustain biodiversity, and assure that groundwater enters the underground stores sufficiently purified to be suitable for human consumption. Agricultural producers in the U. Plant scientists and agriculturists have developed better crops and improved production methods that have enabled farmers to reduce the use of insecticides and chemicals that control certain diseases. Methods such as integrated pest management, no-till or low-till agriculture have been tremendously important in this regard. Some of the success has come through the judicious application of biotechnology to develop new varieties of crops that resist insects and that tolerate certain herbicides. For example, biotechnology was used to develop varieties of cotton and corn that are resistant to attack by cotton bollworm and corn borer. These varieties have allowed farmers to reduce the use of chemical insecticides by between 1. Although biotechnology has increased productivity for American and Canadian farmers, the technologies are not widely available or not adapted for application in parts of the world that could benefit most. Those peoples who most require more food and better nutrition are amongst those that are not seeing the rewards of scientific discovery. In Asia and Africa where rice is the main food, stem borers and other insects, and virus and fungal diseases continue to suppress crop yields. Diseases caused by fungi and viruses destroy crops and decrease yields of crops such as groundnut, chickpeas, papaya, sweet potato, yams, cucumbers, melons, and a host of other fruits and vegetables. However, modern methods of crop improvement, coupled with better farming practices, can make a real and significant difference in crop production in the tropical, poor regions of the world. Biotechnology can be used to reduce crop losses due to disease, insect attack, and post-harvest deterioration and rotting. This is best demonstrated by several examples. Consider the virus disease that causes a severe ringspot disease in papaya - the disease reduces papaya production and kills the trees in Asia, in parts of Latin America, and in Africa. Consider the virus leaf curl disease on white potatoes, the virus that causes leaf yellowing in sweet potatoes throughout east and central Africa. Consider the virus that causes stunting and yellowing in rice, a disease referred to as tungro, throughout central Asia. Each of these important diseases can be controlled through biotechnologies that increase the resistance of these plants to the viruses. Consider next the production of cotton in India, Pakistan, Egypt and other countries where the

boll worm, boll weevil and other insect pests can reduce yields and farmer profits, to the point where farmers in some parts of India commit suicide rather than face the effects that come with financial losses. When smallholder farmers in China and South Africa grew native cotton varieties that contain the B. It is estimated that more that a million farmers combined in these two countries have benefited from insect resistant varieties of cotton. The increased profit came because farmers did not need to purchase or apply insecticides to control the pests. These are real and tangible benefits of biotechnology. Perhaps the most striking examples of how biotechnology can improve human nutrition are found in varieties of rice and canola that have been improved by biotechnology to increase the amounts of beta-carotene. This precursor of Vitamin A is in short supply in diets in many parts of the world. There is great hope and expectation that consumption of foods from these crops will alleviate or reduce the chronic Vit A deficiencies in the diets of many of the poor in Asia and Africa. Other research is underway to use similar types of biotechnologies to increase the levels of other vitamins, and to improve the amount of proteins in crops that have low levels of protein, such as potatoes and cassava. During the past 20 years I have been privileged to participate in the development of knowledge that contributed to certain agricultural biotechnologies. For example, in the early s my laboratory at Washington University in St. Louis, in collaboration with scientists at Monsanto Company, developed a method to produce plants that resist infection by certain types of virus diseases, using biotechnology. My labs at Washington University and later at The Scripps Research Institute La Jolla, CA also made relevant discoveries in the areas of gene regulation, disease resistance, and vaccine development. From the mids, when we made some of the early discoveries in biotechnology, I have made a committed effort to apply them to improve agriculture and human health of peoples in developing countries. The reasons for this decision are obvious: First, there is a growing need to improve the efficiency of food production worldwide, while decreasing reliance on agrichemicals. Second, there is a need to increase the nutrition and healthiness of peoples around the world. Third, there is a great need for more well-trained scientists in developing countries that can develop and use modern methods to improve food production and quality in developing countries. All of us here recognize that there are many challenges to the production, preservation and distribution of adequate food of high nutrition, and to ensure food security for all peoples. Science can provide only part of the solution; nevertheless, we determined to do what we could to address the needs of agriculture in Africa, Asia and Latin America. Claude Fauquet, joined my group at Washington University and we initiated a research project on rice tungro virus disease. This project expanded to include developing efficient methods to produce transgenic rice plants, and methods for tissue culture and genetic transformation in cassava, also known as manioc. In the project was relocated with me to The Scripps Research Institute. Trainees have participated in research programs that are directly related to the research needs of their home institutions. These projects have been successful because of support, largely from the French government and the Rockefeller Foundation, and because of excellent colleagues in other countries. For example, greenhouse and field studies of plants developed at ILTAB that are being conducted in China and other countries in Asia are made possible because regulatory approval for tests has been given by local governmental agencies, most of which have adapted US guidelines and superimposed local scientific oversight. In other countries regulations are not yet in place and testing cannot be conducted. Many countries in Asia and Africa simply do not have the scientific capacity or infrastructure to judge the safety issues that have come to be associated with the use of biotechnology in food production. We, the US, have not kept apace with the rapid growth of science and technology. We have not looked ahead to address the issues of acceptance of transgenic crops and foods derived therefrom, or to the acceptance of biotechnology in general. We, the scientific community, stand ready to participate in whatever manner we can to provide the scientific expertise and technologies that are relevant to improve food production, nutrition, and food safety to those from developing, poor countries. We are anxious to provide training environments, to conduct research on tropical crops, to participate in electronic communications that can build bridges and transfer much needed information. In short, we want to be relevant to agriculture outside of the US as well as within the US What is in short supply, however, are the funds that can make this happen. We need the commitment from our

government to provide the training, and modest infrastructure, that allows scientists to create knowledge to develop and feed themselves bread. We cannot simply send the wheat from which to make bread. What we must do is create the atmosphere of collaboration in science, as opposed to colonialization in science, and work together to further the production of sufficient food of high nutritional content to meet the needs of those that request our help. Only when such needs are met will they be prepared to face their health needs. Only then will vaccines be successful, and anti-HIV drugs and other pharmaceutical treatments reach their full potential. Make no mistake about it; food and nutrition are absolute keys to health, productivity, and social stability. It is not too late for the US to recognize the issues, to chart the way to collaboration, and to be the world leader to implement meaningful solutions. Thank you for your attention and your dedication. Respectfully submitted, July 12,

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Chapter 2 : Biotechnology and the developing world | DaSilva | Electronic Journal of Biotechnology

The role of biotechnology in combating poverty and hunger in developing countries: hearing before the Subcommittee on International Economic Policy, Export and Trade Promotion of the Committee on Foreign Relations, United States Senate; One Hundred Sixth Congress, second session; July 12,

As of FY 98, World Bank reclassified figures used. Agricultural trade and trade liberalisation Trade has an important role to play in improving food security and fostering agriculture. But the actual progress made in the ongoing negotiations has been limited so far and the benefits remained modest. More important for developing countries are: With such companion policies in place, a freer trading environment can also play an important role in fighting poverty and undernourishment. But if left alone, trade liberalisation is unlikely to bring about a massive reduction in poverty and the benefits, if any, could remain in the hands of a few. Support is required to strengthen the supply response of developing countries. Lower export subsidies from or trade barriers to developed countries alone will not generate the investments in roads, irrigation, research and skills needed in developing countries to boost agricultural production and to improve competitiveness in international markets. Nor will it bring quality standards up to the level needed to make significant inroads into industrial markets. And even where exports increase and farmers in developing countries benefit, safety nets may be needed for those who face higher food prices. Exactly how much needs to be spent globally on nutrition, agriculture and rural development, particularly in the developing world? It is difficult to estimate current resource requirements in the fight against poverty and hunger, but it is useful to try to get an idea of the magnitude of the effort required. The two tracks of the proposed strategy cannot be considered independently in terms of mobilizing resources. Investing in measures to improve access to food for extremely poor and undernourished people makes individuals more productive, which in turn enhances the effectiveness of investments in agriculture. Separate assessments of the two elements of the strategy are thus bound to be inaccurate. In terms of direct action against hunger, an estimate has been recently attempted in the study on Asia quoted earlier ADB, This figure probably underestimates the actual needs. Experience suggests that 75 percent of this amount will have to come from the private sector, especially farmers. Only limited funding is available for global public goods GPGs relating to agriculture and rural development, a point that needs to be stressed in the context of the International Conference on Financing for Development. GPGs include technologies for sustainable management of land, forest and marine resources, agro-biodiversity, food safety, transboundary animal and crop pests and diseases, destruction of stocks of obsolete pesticides, and monitoring and predicting the impact of climate change on agriculture and food supplies. The livelihoods of poor people are profoundly affected if GPGs are neither nationally nor privately accessible. Grant funding for GPGs by international agencies responsible for agriculture and rural development must keep pace with the increasing importance of this category of goods, but not at the expense of ODA flows. It is particularly worrying that, in spite of studies which point to the high returns on expenditure on international agricultural research, the funding to the CGIAR system and on technological research in the past 10 years has continuously declined and the CGIAR centres are experiencing increasing financial stress. The inadequacy of funding could obviously lead to a drop in the ability of these centres to conduct research and disseminate knowledge required for raising food production in developing countries and taking people out of hunger and poverty, where much of the required technology generates few privately appropriable returns and hence is of little interest to the private sector. Closing the resource gap: The private and public sectors have important roles to play in the battle against poverty and hunger. These roles are complementary, although each sector may have advantages in different areas. The public sector has a catalytic role, providing the public goods without which private initiative cannot flourish. However, the bulk of resources for agriculture and rural development will be mobilized by the private sector. It is essential to have a policy framework that promotes a pro-investment climate in agriculture. In the last two decades, governments have addressed the anti-agricultural bias of the past by adopting policies to

deregulate agricultural markets, reduce price distortions and promote private economic activity. Such measures are not always enough, however, to attract the investments necessary for sustained productivity and production increases. It is now widely accepted that a more active role by the public sector in public goods provision is an essential part of an enabling environment for agricultural and rural development. Public investment is essential for agriculture and rural development especially in areas such as: Nutrition, like education, is a long-term investment. There are strong reasons why governments must invest in nutrition. The result is that poverty is passed from generation to generation. It is unlikely that parents in developing countries are aware of the importance of micronutrients and nutritional education in this respect is a public good with a high payoff Rural non-farm activities, in spite of their importance for rural economic growth and poverty reduction, often fall victim to the "institutional vacuum": Expansion is thus constrained by lack of credit and market institutions as well as of appropriate infrastructure. Microfinance and other rural financial institutions can mobilize substantial resources to enable poor people to become more productive by providing loans and mobilizing savings. They are an established, cost-effective means of channelling external development assistance to the poor. Financial institutions to channel remittances into productive activities should be promoted. Good progress has been made in working with the Italian government and middle income highly indebted countries in developing programmes in Egypt, Ecuador and Peru under which bilateral debt is cancelled in return for borrower commitments to commit the resources in local currency terms which they would have used to amortise the debt for demand driven rural development and food security programmes. Our hope is that other donor countries will follow this example. One of the surprising aspects of the FfD process is the lack of in-depth consideration given to possible new financing mechanisms, given their potential importance in transferring resources between developed and developing countries and hence the extent to which they could supplement or even substitute for Official Development Assistance funded from the general fiscal revenue of developed countries. While the call for a significant rise in ODA is very welcome, measures have to be taken to ensure adherence to agreed targets. Proposals have to be made which would ensure smoother and more dependable replenishment arrangements especially regarding concessional loan funds administered by the IFIs. The fact that international trading in carbon has already started to build up to substantial levels ahead of the ratification of the Kyoto Protocol and the formal establishment of the Clean Development Mechanism CDM , suggests that it is likely to be far easier to launch market-based transfer mechanisms than to reach agreement on global taxes. The CDM can be thought of both as a market-based mechanism for raising the supply of an important global public good reduced rate of climate change at least global cost and as a conduit for shifting large amounts of resources between rich and poor countries to the mutual benefit of both. Under the Initiative participating countries elaborate Poverty Reduction Strategy Papers PRSPs , and need to make demonstrable progress in their implementation in order to be eligible for debt service relief. There are indeed indications that the Debt Initiative has helped governments to raise resources devoted to anti-poverty measures, but our agencies have also noted that many PRSPs have paid inadequate attention to food security, agriculture and the rural sector. Given the importance of the agricultural and rural sector for poverty reduction in most of these countries, this is a bias that needs to be addressed if the capacity of the Initiative to be effective in reducing poverty is to be strengthened. It is easily within the capacity of the global society to eradicate poverty and hunger in a short period of time. There must be political will to achieve this, and the objective must be addressed directly rather than obliquely. Economic growth, especially broad-based growth in agriculture and the rural economy, is a necessary condition for sustainable poverty and hunger reduction. At the same time, priority action needs to be taken to reduce hunger directly. Hunger is not only an effect but also a cause of poverty. There is plenty of evidence which shows that fighting hunger is an investment with high returns in growth and overall welfare and not just a moral imperative or an act of human compassion. We now know a great deal about what works in the fight against hunger and food insecurity. It is most encouraging that the DAC group of major donors has recognized the need to include an explicit hunger target among its priority development goals, as set out in the Millennium Declaration. The

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World Food Summit in Rome in June will be a significant opportunity for the international community to reaffirm its commitment to the Rome Declaration and Plan of Action. The need to achieve substantial and sustainable poverty reduction, requires that concrete steps be taken to promote agriculture and rural development. Three fourths of the poor live in rural areas and derive the basis for their livelihoods from agriculture or from rural activities which depend on the agricultural sector for their survival. Agriculture and rural development is therefore key to achieving overall economic growth and poverty reduction for most developing countries. The peoples and governments of the countries concerned have the main responsibility for the achievement of hunger and poverty reduction targets. However, countries with widespread extreme poverty and malnutrition cannot raise the resources domestically to directly assist the needy and to foster growth in the productive sectors. These countries cannot make progress in the battle against hunger and poverty without a sustained flow of external resources. National and international funding for hunger eradication and agriculture and rural development must be sufficient to meet requirements. It must be advanced under affordable terms and conditions that do not lead to increased indebtedness among developing countries. Our Organizations consider alarming the declining trend in overall resources for hunger reduction and agriculture and rural development. FAO, IFAD and WFP emphasize the need for concessional funds and grants appropriate to the situations of recipient countries, which has been noted in the review of international cooperation being prepared for the International Conference on Financing for Development. Innovative and market-based means of resource mobilization need to be studied and adopted. Some have been discussed in this paper; others may be developed in the follow-up to the International Conference on Financing for Development. Developed countries, backed by international trade institutions, have an opportunity to demonstrate their willingness to make significant contributions to hunger and rural poverty eradication. They can open their markets, especially to agricultural exports from developing countries, reduce subsidies on farm production, share technology and assist developing countries to take advantage of expanded international markets. The question is not "aid versus trade" but "aid to expand trade". Civil organizations, especially international and national NGOs operating in developing countries, must commit themselves with renewed vigour to addressing the problems of hunger and rural poverty. They have important roles in mobilizing resources and providing technical services and advocacy. They may assume responsibility for monitoring performance against reaffirmed commitments, using score cards as a basis for measuring achievements. The Financing for Development Conference presents a unique opportunity for building a global partnership among all those involved in the effort to achieve the internationally agreed goals on poverty, hunger and development. Such a partnership would act as a guarantee that pledges made are adhered to and that objectives set are achieved. It is through such a partnership that the global community can promote a process of globalisation in which the benefits are more equitably shared than in the past and which is inclusive rather than exclusive. Such an opportunity should not be missed. Latin America and the Caribbean; S. East and Southeast Asia. Category 1 includes countries with less than 2. Not all budget allocations go to functional activity categories. The broad definition includes all elements in the narrow definition as well as research; training and extension; manufacturing of inputs; environment protection; agro-industries; rural development and infrastructure; regional and river development. To come up with more accurate estimates, a more careful calculation is needed that takes into account the local conditions of different regions, the prevalence of the various nutrition problems, the existing capacity and infrastructure, and other relevant factors.

Chapter 3 : Agricultural Biotechnology for Developing Countries - Results of an Electronic Forum

The role of biotechnology in combating poverty and hunger in developing countries: hearing before the Subcommittee on International Economic Policy, Export and Trade Promotion of the Committee on Foreign Relations, United States Senate, One Hundred Sixth Congress, second session, July 12,

World hunger and food insecurity is a recurring problem in most parts of the developing world. Among the many potential biotechnologies that are available, and the different ways in which they can be applied, genetic modification GM of crops demands particular attention. Genetically modified crops possessing genes from different species, could possibly relieve global food shortages. Although initial excitement surrounded the use of GM crops -- that they will provide bigger and better harvests for farmers -- there are still questions about the benefits of such crops. In addition, the general public may not welcome the creation of "super plants" as a viable option in solving global hunger. The environmental impact of GM crops is important with regard to creating food security in developing countries. Genetically modified crops can potentially fail to germinate; kill organisms other than pests that are beneficial to plants and reduce soil fertility; and potentially transfer insecticidal properties or virus resistance to wild relatives of the crop species. A segment of the scientific community often proposes that export earnings from higher agricultural yields can contribute to reducing food insecurity and hunger in developing countries. However, there are many issues and challenges that beg the practicality of this proposal. A few crop varieties, specially created through biotechnology, can improve yields, but biotechnology alone cannot solve the problem of hunger in the developing world. Nevertheless, the potential advantages that biotechnology can confer across a wide range of agricultural applications are in areas such as livestock management, storage of agricultural products and sustaining current crop yields, while reducing the use of fertilizers, herbicides and pesticides. The real challenge is whether we are smart enough to harness the benefits of biotechnological solutions. But what are these solutions? Biotechnology offers a very promising alternative to synthetic foods and an improvement on conventional plant-breeding technologies. Combined with other advanced agricultural technologies, it offers an exciting and environmentally responsible way to meet consumer demand for sustainable agriculture. When the benefits of GM crops reach small and marginal farmers, more Green Revolutions may become a reality. Combating Hunger and Malnutrition Malnutrition is the related term in medicine for hunger. The most recent estimate of the Food and Agriculture Organization says that million people worldwide are undernourished. Many of the million that are undernourished, children being the most visible victims, live in developing countries. Undernutrition magnifies the impact of every disease, including measles and malaria. One example tells us how biotechnology can contribute to combating global hunger and malnutrition. Golden Rice Approximately million children in low-income groups in countries, especially in Africa and South-East Asia, are deficient in Vitamin A. This situation has compounded into a public health challenge. The World Health Organization reports that an estimated , to , Vitamin A-deficient children become blind every year, half of them dying within 12 months of losing their sight. Golden Rice, created by researchers in Germany and Switzerland, contains three new genes -- two from the daffodil and one from a bacterium -- that helps it to produce provitamin A. This rice is available as a possible option for mass distribution, in part due to the waiving of patent rights by biotechnology companies. This is just one among the hundreds of new biotech products, which point to the contributions of biotechnology to society. Intellectual Property and Food Security There are concerns about a technological landscape controlled almost exclusively by the private sector and defined by patent protection. Patents allow large, private firms substantial control over plant genes, which has worrisome implications. If farmers have to purchase seeds during every sowing season, it affects their income and food security. In developing countries, there may be a potential negative impact from Intellectual Property Rights IPR over biotechnological products or the processes used in producing them. IPRs have been held not only by private companies, but also by some public organizations making it impossible to use any aspect of

biotechnology for improving major crop species without infringing a patent somewhere in the process. Because of IPRs, it has not always been possible to separate the biotechnology prospects from the business interests involved. A major consequence of IPR in agricultural biotechnology is that many developing countries which have not yet invested in biotechnology may never be able to catch up in the future. Possibilities Sound decisions need to be based on diligent research. Biotechnology scientists are often highly specialized and technique-focused and may also need additional competency in handling the complicated issue of hunger and food security in developing countries. Biotechnology holds tremendous possibilities for the developing world. The use of high-yielding, disease- and pest-resistant crops will have a direct bearing on improved food security, poverty alleviation and environmental conservation. GM crops will hopefully produce more yield on less land. This may increase the overall productivity and may offer developing countries a means to sustain themselves and reduce worldwide hunger. For instance, five million farmers in India are engaged in planting 7. It is now also possible using biotechnological approaches to increase the extraction of oil from a plant source up to 90 per cent. With the depletion of world hydrocarbon reserves, in the future it is probable that plant oils, such as biodiesel, may compete in terms of price and quality with oil, coal and gas. The real reason for hunger in the world is poverty, which often strikes women--the nutritional gatekeepers in many families--the hardest. Economists argue that resolving hunger requires political solutions and not just agro-technical solutions. According to them, instead of looking at biotechnology as a yet unproven and non-existent breakthrough, decision makers should look at the full body of research that shows that solutions to eliminate hunger are not technological in nature, but rooted in basic socio-economic realities. This is not to say that technology, including biotechnology, does not play a role in reducing, say, malnutrition, but there is no technology that can override the immediate political and social forces that keep people poor and hungry. Biotechnology has applications that can significantly solve the problem of world hunger. Green is the colour of agricultural biotechnology, of fertility, self-respect and well-being. In my opinion, policymakers should pragmatically consider modern biotech discoveries and assets as an important tool for solving the problem of global hunger.

Chapter 4 : Biotechnology: effective solutions for sustainable development

One example tells us how biotechnology can contribute to combating global hunger and malnutrition. Golden Rice Approximately million children in low-income groups in countries, especially in Africa and South-East Asia, are deficient in Vitamin A.

Biotechnology and development, Biotechnology parks, Capacity-building. Abstract The life sciences offer opportunities for revolutionizing human welfare activities. Enriched by inputs from genomic research, biotechnology is a major force for development in all countries. Entwined with culture and socio-ethical values, biotechnology contributes to solving problems like food and water insecurity that impede national development and threaten peace in the developing world. The practice of biotechnology different in many developing countries is nevertheless impressive. The establishment of biotechnology parks and medicinal plant farms in several developing countries is indicative of biotechnology being accorded high policy status in national development; of its significance in the eradication of poverty; and of its use in the empowerment of women in applying the technology for human and social welfare. This review provides several examples of different types of biotech activities that are being employed for development in the developing world. Article Advances in the life sciences offer opportunities for revolutionizing human welfare activities primarily through improvements in the quality and quantity of healthcare. Notwithstanding the availability of these knowledge-rich developments, arising from research in especially molecular biology and microbiology, global problems such as food and water insecurity and the advent of new and re-emergent diseases impede national development in the developing world. Slow resolution of these problems damages the environment, weakens social infrastructure, and constitutes a threat to peace. A goldmine of opportunities in the corporate world, biotechnology enriches the way we do and teach science which has emerged as a global player on the international scene. The enzymatic machinery of the invisible microbe and genetic tailoring are increasingly being used to obtain a variety of bio-based products DaSilva, Biotechnology, varying in scope, scale and practice in many developing countries, is full of entrepreneurial opportunities for the technological progress of the developing world. Hunger, poverty and food security In many developing countries, and inclusive of those in the Islamic world, biotechnology has become a source of economic development and social progress DaSilva, , providing access to technology on credit and peer markets to especially rural poor entrepreneurs Holaday, ; Lalljee and Facknath, Poverty-stricken rural populations are confronted with inadequate water resources Serageldin, , low crop yields, food shortages, food insecurity, a deteriorating environment, and hunger Box 1. Over 80 low-income food-deficit developing countries LIFDCs possess neither the ability to produce sufficient food to feed their own populations nor the foreign-exchange reserves to import food supplies to meet the deficits. In comparison, the number of people, in East Asia, fell from million in to million in Poverty in urban areas, emerging in some industrialized societies, is soon expected to overtake rural numbers in the coming decades. Food production, population and poverty are closely connected Table 1. Opportunities and constraints in agricultural biotechnology in developing countries are of significance in responding to the challenge of poverty in the 21st century Persley and Lantin, as they influence the development of national strategies that minimize environmental, health and social risks; and that address the nutritional needs of poor-resource farmers. The United Nations Decade for the Eradication of Poverty Decade - focuses on the environment, development, human rights, and vulnerable groups. In the Horn of Africa Djibouti, Eritrea, Ethiopia, Kenya and Somalia, about 70 million people suffer from malnutrition, food scarcity and famine in harsh and inhospitable climates not conducive for efficient agricultural productivity FAO, Resilient communities live under harsh drought conditions e. Combating poverty involves actions to increase food security; to improve the availability and quality of basic services; to generate opportunities for sustainable livelihoods: It is in this context that biotechnology can make a contribution. As President Jimmy Carter said: Without adequate food supplies at affordable prices, we cannot expect world health or peace".

Profit-oriented agricultural biotechnology is now addressing poverty, food insecurity, conservation of the environment, and sustainable development. The involvement of resource-poor farmers from LDCs in the design and formulation of field trials; their education and financement as transmitters of new knowledge, of good practices, and productive services in rural communities is now being encouraged in international programmes. Designed for resource-poor farmers, this new protein-rich variety is tolerant to drought and acid soils, and generally resistant to a wide range of African insect pests. Active participation in community development assists in the way out of poverty. Karanja et al described close collaboration with participating NGOs in co-financed experimental trials in four Senegalese villages. In village-based science education exercises over farmers, inclusive of women farmers, were exposed to environmental and societal benefits resulting from the use of biological nitrogen-fixation technology. Also Land to lab technical sessions, with a focus on environmental bioremediation, and employing the principles of show and tell, and earn and learn, were organized by the local scientific community for some farmers from the villages of Balapur, Kelzar, Sawanga, and Talodi during an international conference on global sustainable biotechnology in Nagpur, India. Different kinds of technology, new crop varieties, floriculture, aquaculture and micro-enterprises such as mushroom production are tested with the active participation of eager to learn villagers. Talents and skills, individual and collective, are crucial to the constructive evolution of an important bridge between the rural poor and local governance, and between rural educational and urban research institutions. Eighteen other villages, with a population of Emphasis is on achieving food security through an inexpensive and uninterrupted access to nutritious and wholesome foods for use in daily food intakes by all communal segments. Success in ensuring food security has been noted in several developing countries FAO, Plant biotechnology, which is one of the many approaches involved to solve the complex problems of hunger, poverty and food insecurity, may be an appropriate technology within reach of rural and disadvantaged farmers. Use of low-risk and low-cost biotechnology techniques such as micropropagation could be beneficial. There are many instances of plant biotechnology enabling small farmers in Argentina, India, Morocco, and Uganda to obtain increased and sustainable crop yields. In the Democratic Republic of the Congo, tissue culture plays a vital role in helping establish food security that was affected by war and subsequent neglect. Cassava clones, obtained from the International Institute of Tropical Agriculture in Nigeria, are propagated as disease-free plantlets to start-up crop productivity which is maintained through use of crop protection techniques FAO, In Kenya, tissue culture of disease-free banana plantlets has helped raised yields, and secure farm household incomes threatened by the dwindling loss of the coffee cash crops. Co-operation between the Kenya Agricultural Research Institute and the South African Institute of Tropical and Sub-Tropical crops has helped former coffee-growing farmers to use biotechnology for development, and to make the transition in earning new income. And, co-operation between the International Potato Centre in Peru and Ugandan National Agricultural Research Organization has resulted in the introduction and growth of disease-free potato crops in the Kabale District of southwest Uganda. In all three examples, the training of Congolese, Kenyan and Ugandan farmers in low-cost plant biotechnology techniques features prominently in long-term co-operation. A case study of how biotechnology can benefit the poor and the hungry Wambugu, indicates the potential of biotechnology in tackling poverty and hunger Spillane, Concerns, fears, and promises expressed with GM crops and foods are not voiced with fermented foods that are prepared in near-safe hygienic conditions and that contain whole or parts of natural organisms. Debate concerning GM crops and foods is emotional and fierce Box 2 , public and technical Skeritt, Opposing arguments focus on the economic loss of crop genetic diversity and biodiversity; the threat to the use of generic medicinal products; the indiscriminate appropriation of native intellectual property resources and absence of adequate compensatory measures; non-conformity with religious, cultural, and ethical issues, and monopolistic trends given that 10 top life science industries have ownership of 15 major food and non-food crops. Strategies for assessing the safety of foods produced by biotechnology, WHO, Geneva, http: There is a continuing need of safety assessment of GM foods and products to address health hazards possibly arising from the release of GMOs into the environment WHO, An

integrated stepwise approach in quality control, inclusive of random control trials and periodic updates in safety assessment, helps in assuring and securing the safety of GM foods in the public sector. Restriction in the imports of GM products has been introduced in Brazil, and imports of GMOs have been banned in Sri Lanka pending further review in relation to environmental and food safety Anderson and Yao, In the industrialized societies and some developing countries public protest has led to demands for risk-assessment research in the cause-effect phenomena associated with GM crops; and subsequent stricter regulation has resulted in differing transatlantic viewpoints Levidow and Carr, With emphasis on the safety component in GM agriculture, some developing countries are in the process of drafting biosafety guidelines whereas others have enacted formal issuance. GM agriculture is not new. Several developing countries have embraced GM agriculture Krattiger, Some GMO releases have been conducted in about 25 developing countries. And in countries in transition to development in Eastern Europe Bulgaria, Romania and the Ukraine, field trials, in , had just begun or were scheduled to get underway. In China, over 50 per cent of all crops are assumed to have been engineered genetically. Gene-altered crops rice, wheat, beet, potato, tomato, corn, peanut, rapeseed, sweet pepper and cotton crops have been grown since Research in India with GM crops rice, rapeseed, potato, eggplant, cauliflower, chilly, and tobacco is being conducted at several academic, governmental and private institutions with built-in biosafety and monitoring protocols. GM fruits avocadoes, pineapples and mangos exist. GM plants constructed with bioremediating functions help protect the environment and the plant. These include caffeine-free coffee plants, tobacco plants containing a diabetes vaccine, and soybeans with a "heart-friendly and healthier" oil profile and an improved digestible protein content. Arid land and desert biotechnology The Middle East, with its varied characteristics in culture, economies, the environment, governance and religion, is home to semi-urban and urban agriculture that seems to have originated in the Fertile Crescent of the Middle East homeland of the first farmers Wilford, Rich in the eight founder crops: Arid lands and deserts make up a large part of Africa. Two-thirds of the continent is desert or drylands. Also, some of the poorest countries in the world, with heavy population growth, meagre national resources, a weak or negligible technological base, primary level education, and inadequate technical infrastructures, are found in Africa Box 3. A combination of natural hazards cyclic periods of droughts and floods along with over-cultivation and over-grazing have transformed once fertile substrates into dry and sterile desert-like soils. Of the 42 high in-debt countries, 39 are located in tropical desert regions Farmers are faced with the problems of soil erosion, plant viruses, high-cost chemical-based fertilizers and pesticides Deforestation, pollution of soil with toxic wastes, urban development, etc. UN Agriculture in several arid African developing countries is linked to water availability and security. Vulnerability of agricultural and water resources, ecosystems, food production, utility goods, shelter, and human health is high in regions with weak infrastructures. Several of these African water-stressed countries are dependent on a singular economic base agriculture, which in dryland Middle Eastern OPEC countries exists along side an additional naturally occurring export-value resourceoil. The African dryland LDCs, do not have the economic means nor the well-defined strategies to respond effectively, in time, to the onset of malnutrition and poverty, and to the recurrence of vector-borne diseases. Agriculture, in these countries which have a low livelihood base and inadequate socio-cultural services, is further disadvantaged by fragile ecosystems and the phenomenon of globalisation. Against this background, the use of GM technology could make a beneficial impact through the use of improved seeds and disease-free high-quality plantlets to grow high-value commercial crops in low-rainfall areas. In addition, rural education could help promote the benefits of such technology in diversifying complementary agricultural practices such as fisheries and floriculture. Arid and semi-arid countries are known to benefit from the production of high-quality tissue culture reared plantlets; from the seeding of rural biotech industries e. Examples of activities in dryland agriculture are provided in Table 2. The containment of desertification in arid lands occurs in the ability to bioconvert their ecological disadvantages in to economic benefits coming from the cultivation of desert crops; development of saline agriculture and aquaculture, and the rational use of water, wastewater and other water resources. Seawater agriculture or the growth of salt-tolerant crops on land

with ocean waters, and of a variety of halophytic crops grasses, shrubs and trees encountered in coastline marshes or in saline desert terrains is full of promise. Grasses and plants such as: Distichlis palmeri salt grass , Salicornia glasswort , Atriplex saltbush , Suaeda sea blithe , and the succulent Batis saltworth are used to supplement meagre feed intakes of normal palatable plants in livestock feeds. Sea-water agriculture in China involves almost , hectares of coastal land in the Hainan, Hebei, Guandong and Shandong provinces. Of economic importance in coastal agriculture, halophytes are cultured for landscaping and as fodder in Egypt; as ornamental plants in Morocco; and for greening and landscaping arid soils in Tunisia, Saudi Arabia and the UAE Table 3. In Chile, the leguminous tamarugo tree in the Atacama desert is being tested for resource development with the Aymara communities; in Senegal biofertilizer inoculants are being developed for application in Middle East soils; and in Pakistan similar material is being prepared for use in desert agriculture in Kazakhstan. Several initiatives exist concerning the greening of desert lands Table 4. With this raison de faire, biotechnology parks use an amalgam of entrepreneurial energies and networking skills to promote co-development of biotech processes, to transfer biotech know-how, and to provide technical services. In brief, biotechnology parks incorporate incentives that provide for an academic environment unencumbered by bureaucratic guidelines; that transform concepts and ideas into environment-friendly bioindustries, and that attract start-up angel, seed and venture capital, and tax exemptions. Biotechnology parks in several developing countries reveal a political commitment in transforming the potential of modern biotechnology knowledge into reality for the benefit of all strata of society Table 5. The Park Figure 1 , which came into being in July , aims to develop an integrated approach involving technology identification, incubation, dissemination, training and retraining, development of necessary techno-infrastructure through feasibility studies using the criteria of value addition and market demand. The park, designed on the principle of decentralized production with support from relevant centralized services, promotes a series of high-tech biotechnology-based enterprises aimed at capturing a number of markets in the areas of Ag-biotech, Food biotech, Medical biotech etc. Moreover, the Park will host industrial incubation centres, an ultra modern multimedia information complex, and quality verification reference laboratories. The main objectives of this biotechnology park are to bring together women entrepreneurs, scientists, financial sponsors and industry for purposes of generating openings for skilled employment of women.

Chapter 5 : Poverty eradication Sustainable Development Knowledge Platform

Role of Biotechnology in Combating Poverty & Hunger in Developing Countries: Hearing Before the Committee on Foreign Relations, U.S. Senate Unknown Binding Be the first to review this item See all formats and editions Hide other formats and editions.

The aim of this conference is to allow a more detailed and comprehensive discussion of this topic. The aim of this document is to provide some brief background to the subject as well as to mention some of the factors that should be considered in the conference. The first edition of the State of Food Insecurity in the World, published by FAO in October , provided a recent update on the status regarding hunger in the world for those with access to the Web, the report can be found at www. It estimated that in there were roughly million undernourished people in developing countries and 34 million in developed countries , i. The majority million was in Asia, including and million in India and China, respectively, while there were million undernourished in sub-Saharan Africa. The report also examined changes from to in the proportion of undernourished people in a selection of countries, to try and understand the factors determining such changes. The analysis highlighted, as other reports have previously done, that many different demographic e. The global population size is currently six billion, and it is rising rapidly. By the year , it is expected to reach 7. Where will the food come from to feed these additional mouths? An important factor to be considered is that much of the land currently used to produce food is being degraded - largely due to overgrazing, poor farming practices and deforestation. To counterbalance this, one might ask whether there is much additional land that can be brought into use for food production. There is some scope for extending the land area used for production in Africa and South America, although this may be at the expense of forestry and wildlife. For Asia there is little scope for extension of the land base. Under these conditions, will it be possible to provide enough food for the additional billions, without using biotechnology in plant, animal and fish production? Is biotechnology indispensable if we are to successfully meet the challenge of an increasing world population? However, the problem of hunger is complex and does not just depend on the amount of food produced. Currently, enough food is produced globally to feed all its inhabitants. Nevertheless, around 15 percent of them are undernourished. Is the unequal distribution of resources and food a greater threat to world hunger than the sheer quantity of food produced? Biotechnology may increase the amount of food produced but will it affect the key problems of unequal access to food? Is it possible that we may end up in the situation where the amount of food produced globally increases, with the help of biotechnology, but so also does the number and proportion of hungry people? However, cereal availability varies greatly from one country to another: Moreover, within each country, access to food or the means to produce food is very uneven among households. Consequently, in many countries, large segments of the population do not have enough food. And the large majority of the million chronically undernourished are in the poor peasant farming community. World food security, therefore, is not an essentially technical, environmental or demographic issue in the short-term: It is also a matter of insufficient purchasing power of other poor rural and urban consumers, insofar as the poverty of non-farmers is also a product of rural poverty and migration from the land. The products developed so far have, with few exceptions, not been targeted towards poor farmers in developing countries. Will biotechnology, which can potentially increase the efficiency and quality of food production, provide tools to aggravate inequalities in the world? If trade barriers are progressively reduced, through organizations such as the WTO and export of food from developed to developing countries becomes easier and more commonplace, is it possible that biotechnology will make this trade more profitable, thus creating or increasing the dependency of developing countries on developed countries for food? Discussion in this conference should also address whether particular biotechnologies have especially high or low potential to reduce hunger and increase food security in developing countries, or whether the application of biotechnology within specific agricultural and food-related sectors crop, forestry, animal or fisheries or within specific

regions of the developing world can have greater or lower impact on hunger and food security in developing countries. For those wishing to be reminded of the types of biotechnologies currently available in the four sectors, the Background Documents of the first four conferences may be useful. For the crop sector, brief descriptions of genetic modification, micropropagation and biotechnologies based on molecular markers were provided. For the forestry sector, brief descriptions of genetic modification and biotechnologies based on vegetative reproduction or molecular markers were provided. For the livestock sector, reproductive biotechnologies embryo transfer, cloning, etc. For the fisheries sector, brief descriptions of molecular marker biotechnologies, induction of polyploidy, sex-reversal and creation of single sex fish groups, hybridization, selective breeding, freezing of male gametes, genetic modification and DNA-based technologies for fish health were provided. Interest in the theme of the conference was high, based on the number of people registered and of messages posted. The level of participation was the highest of the six conferences, with 18 percent of those registered submitting at least one message. The main impetus behind choice of this theme for the conference was to allow more in-depth discussion of one of the factors considered in previous conferences especially on the crop sector to have an impact on the appropriateness of agricultural biotechnologies, i. Certain aspects of discussions concerning biotechnology have been quite polarized. One of the most hard-fought debating issues regarding biotechnology and especially GM crops, is whether they can be of potential value for food security and hunger in developing countries. In the conference, when discussing specific applications of agricultural biotechnology, participants tended to focus on the crop sector. This even led to some individuals e. Impacts of biotechnologies in the fisheries or forestry sectors were unfortunately not discussed. Although the range of available biotechnologies is quite wide, there tended to be most emphasis on a single biotechnology - genetic modification. On many specific points of debate, considerable differences of opinion were expressed by various parties and there was often a social-political dimension to such differences. The first solution involves community access to land, preservation of agricultural diversity and ecologically based land management while the second involves increasing the levels of exports from developing countries so they have the purchasing power to ensure their food security. He suggested that people who believed in the first viewpoint would rank biotechnology as a very low priority while those who believed in the second viewpoint would support the use of biotechnology to increase exports and the efficiency of agricultural production. A large number of topics were covered in the six and a half weeks that the conference lasted. In addition, some participants provided references in their messages to material published on the World Wide Web so that others with access to the web could pursue these topics further. A considerable amount of information directly or indirectly relevant to this debate is freely available on the web. The messages can be viewed at www. In a few cases, where individuals posted more than one message on a single day, they can be differentiated by the order in which they were posted e. There seemed, however, to be some differences in the relative importance participants attributed to the various causal factors. Growth of the human population is thus central - if it continues to grow then, even if natural resources are shared equally, the limit will eventually be reached. Again at the wider level, there was a small discussion about how the use of biotechnology in developed countries could be used to reduce hunger in the developing world note that, this topic apart, discussions in the conference focused appropriately on the potential impact of applying biotechnology in developing, and not developed, countries. He described a relatively simple method that he suggested could be used to identify policy and institutional factors e. I would never be prescriptive as what will be most appropriate in what circumstances, but the more options on offer the better surely? Firstly, food supply exceeds demand so prices fall and access to food by the poor is increased as the food is cheaper. Secondly, however, as prices are lower and farmers in developing countries are not subsidized, they are forced to absorb costs that are higher than the prices they can get for their commodities on the international market, which leads to them producing only for their limited domestic markets or for subsistence use. The end result is that small and poor farmers leave the land while farms become bigger and concentrated in the hands of fewer individuals. Some of the discussion was general, regarding the potential environmental impact of GM crops

and the effect it might have on hunger and food security. It is a public health problem in countries, especially in Africa and South-East Asia, which affects young children and pregnant women in low-income countries hardest. An estimated to vitamin A deficient children become blind each year, half of them dying within 12 months of losing their sight these figures are taken from the World Health Organization website www. However, it is a poor source of many essential micronutrients and vitamins. The endosperm, the starchy portion of the grain left after milling, does not contain provitamin A also known as beta-carotene , from which humans can make vitamin A. The Golden Rice variety, however, contains three new genes two from the daffodil and one from a bacteria so that the rice plants produce provitamin A. The plant variety was produced by researchers collaborating in Germany and Switzerland and their work was reported in the journal Science on 14 January There is large interest in making the variety available to farmers in developing countries but it is currently in the testing phase and so may not be released publicly until a few years time. As mentioned earlier, discussions on the potential value of biotechnology for food security and hunger in developing countries can be quite polarized. Golden Rice, which has also been the subject of much public and media interest, has allowed this polarization of viewpoints to become far more specific, as it is a specific biotechnology product directed towards a specific nutritional problem in developing countries. The issue of how Golden Rice was presented to the public was raised by participants. For some, the approach was that the variety exists and so why not try it e. For others instead, the approach was that hunger and nutrition problems exist and why should Golden Rice be used compared to other potential solutions to the problems e. The first concern was that if only a limited number of varieties were genetically modified and they were widely cultivated, then this would have a negative impact on crop biodiversity. In this conference, however, it was considered only in respect of its potential effect on hunger and food security. These include i potential failures of GM crops; ii potential negative impacts of Bt-crops i. GM crops producing toxins of the soil bacterium Bacillus thuringiensis , such as increased resistance to Bt toxins by the pests; crop losses due to killing non-target biocontrol organisms and reductions in soil fertility due to Bt toxins remaining in the soil; and iii potential transfer of insecticidal properties or virus resistance to wild relatives of the crop species. There seemed to be agreement that developing countries should not be used as inappropriate testing grounds by scientists and companies promoting GM organisms e. By and large, the investors and shareholders themselves are also large institutions with their own shareholders. The private industry was also seen to have an impact on food security and hunger by its influence on the biotechnology research agenda. In his opinion, the private companies had too much power and weight in determining the research agenda. He argued that biotechnology scientists, due to the nature of their work, are often highly specialized and technique-focused and thus are not competent on the complex question of hunger in developing countries.

Chapter 6 : Background Papers on biotechnology in developing countries

Loading The role of biotechnology in combating poverty and hunger in developing countries: hearing before the Subcommittee on International Economic Policy, Export and Trade Promotion of the Committee on Foreign Relations, United States Senate, One Hundred Sixth Congress, second session, July 12,

Meeting the Needs of the Poor? Bioengineered Food Crops Have Real Potential as a Tool in the War on Hunger, but So Far That Potential Remains Largely Untapped Food and Agriculture Organization FAO, May 17, By introducing high-yielding plant varieties, agro-chemicals and new irrigation techniques into agriculture systems around the world, the Green Revolution of the s and s boosted crop yields and helped lift millions of people out of hunger and poverty. Billions suffer from micronutrient deficiencies, an insidious form of malnutrition caused by an inadequate diet. And over the next 30 years an additional 2 billion people will need food-- yet the natural resource base on which agriculture depends is growing increasingly fragile. Can the "Gene Revolution"-- the use of biotechnology in agriculture-- contribute to meeting these challenges? Using biotechnology, scientists can alter the genetic makeup of plants to make them produce more nutrients and vitamins. A Global Debate Science can be an ogre or an angel, depending on how one looks at it. The Green Revolution, for example, is not without its detractors, who argue that it promoted overuse of water, pesticides and chemical fertilizers, making poor farmers dependent on these inputs, and in some cases seriously damaging the environment in the process. Today, the rising profile of biotechnology in agricultural production has sparked a similar global debate. Some types of biotechnology have been around for millennia, and probably began when our ancestors used microorganisms to make bread, wine and cheese. The current era of modern biotechnology was made possible by the use of molecular techniques to "cut and paste" genes from one cell to another. Supporters hail genetic engineering as essential for addressing food insecurity and malnutrition in developing countries. Opponents counter that it will wreak environmental havoc, increase poverty and hunger, and lead to a corporate takeover of traditional agriculture and the global food supply. Pros and Cons On the one hand, there are compelling arguments for altering the genetic makeup of food crops, notes the report. Doing so, it may be possible to increase the availability and variety of food by improving agricultural productivity and reducing seasonal variations in food supplies. Pest-resistant and stress-tolerant crops can be developed to reduce the risk of crop failure due to drought and disease. Crops could be made to grow on poor soil in marginal lands, increasing overall food production. Biotechnology also offers the possibility of reducing the use of toxic agricultural pesticides, and may also improve the efficiency of fertilizer and other soil amendments. On the other hand, cautions FAO, the scientific assessment of the environmental and health impacts of genetic engineering of crop plants is still at an early stage and should be made on a case-by-case basis. Moreover, the organization emphasizes the need to ensure that the prospective benefits of biotechnology in agriculture are shared by all people, rather than a select few. Indeed, while SOFA notes that poor farmers and consumers in developing countries can benefit greatly from biotechnology, it adds that so far only a few are actually doing so, and that as the biotech sector develops "there is clear evidence that the problems of the poor are being neglected. The report notes that while public- and private-sector biotech research and development are being carried out on more than 40 crops worldwide, there are few major public- or private-sector biotech programs addressing the problems of small farmers in poor countries. Even the major food crops of the poor-- wheat, rice, white maize, potato and cassava-- are also being neglected, according to SOFA At the same time, biotech plants with traits of interest to the poor, including drought and salinity tolerance, disease resistance, or enhanced nutrition, are receiving little attention. As The State of Food and Agriculture points out, however, many pressing questions have yet to be answered. How can more farmers in more countries gain access to the technologies that are emerging from the Gene Revolution? Which biotech research priorities could most directly benefit the poor, and who will develop innovations for the majority of developing countries that are too small in terms of market potential to attract large private-sector investments

and too weak in scientific capacity to develop their own innovations? How can we facilitate the development and international movement of safe transgenic organisms and promote the sharing of intellectual property for the public good? In The State of Food and Agriculture , FAO takes up these and other issues and suggests some lines of action that individual countries and the international community could take in order to make biotechnology a more potent tool in the war on hunger.

DOWNLOAD PDF THE ROLE OF BIOTECHNOLOGY IN COMBATING POVERTY AND HUNGER IN DEVELOPING COUNTRIES

Chapter 7 : Biotechnology -- A Solution to Hunger? | UN Chronicle

But agricultural biotechnology can play a major role in helping end this human suffering. Through gene manipulation, scientists have been able to alter many of the staple food crops that developing nations depend on, such as cassava, rice, maize and potatoes, to make them more resistant to disease, more nutritional and more productive.

But if the environmental movement has its way, further development of this promising new technology will be halted, consigning hundreds of millions of impoverished residents of the developing world to additional decades of starvation and misery. Environmentalists argue that agricultural biotechnology poses too many risks to human health and the environment, and that its use should be sharply curtailed or even banned altogether. However, an overwhelming number of scientists from around the world emphatically dismiss these objections as unfounded. It would thus be a tragedy if misinformation spread by the environmental movement about agricultural biotechnology is allowed to win the day and the world is deprived of its great potential to improve and save lives. There is simply too much at stake. Starvation and disease continue to hamper the poorest nations of the world: At least million people suffer from malnutrition. Of the 42 highly indebted poor countries of the world, 39 are located in tropical or desert regions where growing conditions are less than optimal. Through gene manipulation, scientists have been able to alter many of the staple food crops that developing nations depend on, such as cassava, rice, maize and potatoes, to make them more resistant to disease, more nutritional and more productive. With the help of bioengineered seeds that "vaccinate" crops with their own herbicides and pesticides, crop losses to disease and insects can be minimized and farmers can produce more plentiful harvests. Also, crops can be grown on previously unplantable lands using no-till farming, a type of farming that does not require heavy-duty farm machinery to till the soil but relies on the herbicides within the plant to destroy unwanted weeds. With the no-till technique, farmers can plant on land previously too steep for farming. Researchers at the Swiss Federal Institute of Technology, for instance, have developed a new breed of rice that has a higher content of iron, thus helping to address an iron deficiency suffered by 3. Iron deficiency can lead to the development of anemia, a disease characterized by insufficient red blood cells. The rice also contains enough Vitamin A to satisfy daily requirements in just a gram serving while the same amount of standard rice contains little or no Vitamin A. Rice fortified with Vitamin A would be especially welcomed by several Asian countries where 80 per cent of daily caloric intake consists of rice. Just recently, an international team of scientists used genetic engineering to create a tomato with three times the normal level of beta-carotene, which the human body processes into Vitamin A. Researchers have developed a vaccine for the hepatitis virus that can be taken via banana consumption, negating the need for injection vaccines that require extensive storage and sterilization. Nearly 2, scientists from around the world - including respected Nobel prize-winners - have signed a petition organized by Dr. Prakash, director of the Center for Plant Biotechnology Research at Tuskegee University, strongly endorsing the environmental and nutritional safety of foods modified through agricultural biotechnology. Sadly, affluent Western environmentalists are more concerned with rigid adherence to their wrongheaded ideology than saving the lives of millions of people in the developing world. Louis Dispatch, January 9,

Chapter 8 : Catalog Record: The role of biotechnology in combating | Hathi Trust Digital Library

The hearing, chaired by Nebraska Senator Chuck Hagel, focused on the role of biotechnology in combating poverty and hunger in developing countries. Dr. Beachy was introduced at the hearing by Missouri Senator Christopher "Kit" Bond.

Chapter 9 : World Hunger Notes -- Biotechnology: Meeting the Needs of the Poor?

Undernutrition and underlying problems affect not only developing countries, but developed countries, as well, due to

economic instability 3. The world has the food and technical expertise to end hunger, but concerted political effort is lacking.