

Keynote Address: Global Implications of Biotechnology

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Abstract

Nearly 40,000 people -- half of them children -- die every day due to hunger-related causes. In the year 2000, six national science academies (U.S., Britain, Brazil, China, India, and Mexico) and the Third World Academy of Sciences endorsed biotechnology as a valuable tool to help alleviate world hunger. Biotech-derived plants resist pests and disease, a major cause of crop damage in the developing world. More nutritious strains of staple crops are also being developed using biotechnology. Golden rice, which has an increased iron and beta-carotene content, could help more than 100 million children who suffer from vitamin A deficiency. Research is underway on fruits and vegetables that could deliver life-saving vaccines. Finally, biotechnology sustains the land's ability to support continued farming by developing crops that more efficiently absorb nutrients from the soil so farmers need less fertilizer and non-renewable resources, such as oil and natural gas.

On October 16, 2000, we celebrated the World Food Day -- a day to remember that not all people around the world enjoy the same safe, bountiful food supply that we do in the United States. Despite major strides in combating hunger over the last 30 years, 800 million people go to bed daily on an empty stomach, and there are 40,000 hunger-related deaths every day. This 'silent holocaust' is 'unconscionable', pleads Ismail Serageldin of the World Bank. Mahatma Gandhi, the apostle of peace, called hunger the greatest of all violence. Worldwide, one in three children is underweight, and one in five is stunted due to undernourishment. Nearly 40,000 people -- half of them children -- die every day due to hunger related causes. By 2020, the number of undernourished could well surpass 1 billion.

In many developing countries, where subsistence farmers eke out meager livings, and the ability to provide enough food for survival is often less than assured, the vital importance of staple crops such as rice, sweetpotato, and cassava cannot be overstated. In many places, the loss of a crucial crop to pests, diseases or weather can mean the difference between life or death, straining the resources and threatening the well-being of entire communities.

In rapid succession, the leading scientists around the world are attesting to the health and environmental safety of agricultural biotechnology, and now they are calling for genetically modified crops to be extended to the people who need them most -- hungry people in the developing world. More than 2,900 eminent scientists, including three Nobel laureates, have signed a statement of support (www.agbioworld.org). Expert panels with the World Health Organization, the Food and Agriculture Organization of the United Nations, and the Organization for Economic Cooperation and Development have made strong statements supporting the safety of the crops. Numerous scientific societies are passing proclamations in support.

And just last month, six national science academies (U.S., Britain, Brazil, China, India, and Mexico) and the Third World Academy of Sciences, issued a joint statement not only endorsing biotechnology but urging companies, governments, and charities to extend it to the developing world.

The need for new technologies is great, as the seven academies describe:

- "Today, there are some 800 million people who do not have access to sufficient food to meet their needs."
- "Malnutrition plays a significant role in half of the nearly 12 million deaths each year of children under five in developing countries."
- "In addition to lack of food, deficiencies in micronutrients (especially vitamin A, iodine, and iron) are widespread."
- "(Global climate change) and alterations in land use will exacerbate the problems of regional production and demands for food."
- "In developing countries...about 650 million of the poorest people live in rural areas where the local production of food is the main economic activity. Without successful agriculture, these people will have neither employment nor the resources they need for a better life . . . arming the land is the engine of progress . . . in less developed countries."

Coupled with that great need is the fact that the rate of food production globally has dropped from three percent per annum in the 1970s to one percent per annum now. Burgeoning population, especially in the developing world, will soon outstrip food production.

These scientists, members of their nations' most respected scientific bodies, are urging private and public funding and cooperative research to ensure that the benefits of biotechnology are extended to solving great needs among needy people. They urge a blending of market-driven and public-funded research that will provide benefits where little or no profit opportunity exists. The scientists challenge developers of genetically modified crops to make sure that their efforts address these needs, but they make it clear that private companies cannot be expected to do this work alone. "Governments should fully recognize that there will always be public interest research requiring public investment, even in the market-driven economy."

The seven academies say private companies must "share with the public sector more of their capacity for innovation" and that "care should be taken so that research is not inhibited by over-protection of intellectual property" ([patents](#) on genetic discoveries).

In many countries, from Africa to Indonesia to South America, the cassava plant is an important source of starch, carbohydrates, protein, calcium, and vitamins A and C, [\(1\)](#) and plays a key role in the diet and income of some 500 million people worldwide. [\(2\)](#) Sweetpotatoes are another staple that provides a vital source of calories and essential vitamins and minerals to millions in the developing world. [\(3\)](#)

Yet in 1998, the people of Africa lost 60 percent of the cassava crop -- one of their most important sources of calories -- to mosaic virus. [\(4\)](#) Sweetpotato yields in many African nations have been laid dangerously low -- in some cases losing up to 80 percent of expected yields -- due to the sweetpotato weevil and also the feathery mottle virus (SPFMV). [\(5\)](#) And The European corn borer likewise destroys approximately seven percent, or 40 million tons, of the world's corn crop every year -- equivalent to the annual food supply, in calories, for 60 million people. [\(6\)](#)

Biotechnology is working to solve these problems by producing plants that resist pests and disease, a major cause of crop damage in the developing world. Biotech corn, which is already widely used in the United States, produces its own protection against the corn borer. Research is under way on sweetpotatoes that produce their own protection against SPFMV, as well as beans, cassava, and other staple foods with enhanced natural tolerance to diseases, pests, and physical stresses. [\(7\)](#) In 1997, the World Bank Consultative Group on International Agricultural Research estimated that biotechnology could help improve world food production by up to 25 percent.

Biotechnology is also being used to develop more nutritious strains of staple crops. Researchers have been working to develop varieties of cassava that more efficiently absorb trace metals and

micronutrients from the soil, have enhanced starch quality, and contain more beta-carotene and other beneficial vitamins and minerals.⁽⁸⁾ A strain of "golden rice" that packs more iron and beta carotene, a precursor of Vitamin A, could be on the world market within a few years. This rice crop could help the more than 100 million children worldwide who suffer from vitamin A deficiency, the developing world's leading cause of blindness. It will also benefit the 400 million women of childbearing age who are iron-deficient, placing their babies at risk of physical and mental retardation, premature births, and natal mortality.⁽⁹⁾ Biotechnology could well help to prevent these maladies and others by producing more healthful, nutritious crops.

Biotechnology could also have significant impact on fighting disease. Research is already underway on fruits and vegetables that could one day deliver life-saving vaccines -- such as a banana that could deliver the vaccine for Hepatitis B, and a potato that provides immunization against the Norwalk virus. Biotechnology can make it possible to inoculate against deadly diseases with locally grown crops that are easy to handle, distribute, and administer.

At the same time, biotechnology can help farmers produce more nutritious crops, while sustaining the land's ability to support continued farming. By developing crops that more efficiently absorb nutrients from the soil, biotechnology can help farmers produce more on land already under cultivation, and may reduce the need for costly inputs such as fertilizer and non-renewable resources, such as oil and natural gas. A Mexican scientist, Luis Herrera Estrella, has shown that by using biotechnology tropical crops can be modified to tolerate aluminum and acid soils to significantly increase the productivity of corn, rice, and papaya. Biotech crops that require less tilling may help to decrease soil erosion. And the development of plants that can grow in tough conditions, such as drought, or dry or poor soil, may make it easier to farm marginal lands, helping to keep fragile soils such as wetlands and rainforests out of food production.

Biotechnology holds tremendous promise for the developing world. In the words of Dr. John Wafula, the head of biotechnology research at the Kenya Agricultural Research Institute (Kari): "The need for biotechnology in Africa is very clear. The use of high-yielding, disease-resistant, and pest-resistant crops would have a direct bearing on improved food security, poverty alleviation, and environmental conservation in Africa."⁽¹⁰⁾ Likewise, as Nigeria's minister of agricultural and rural development, Hassan Adamu, recently wrote in an opinion editorial to the Washington Post: "To deny desperate, hungry people the means to control their futures by presuming to know what is best for them is not only paternalistic but morally wrong . . . we want to have the opportunity to save the lives of millions of people and change the course of history in many nations." Failing that, Adamu warns, "The harsh reality is that, without the help of agricultural biotechnology, many will not live."

Recently Monsanto Company announced that it would provide royalty-free licenses for any of its technologies that can help further the development of "golden rice." The new rice, being developed at the Swiss Federal Institute of Technology with support from the Rockefeller Foundation, holds promise to help hundreds of thousands of children who suffer from life-threatening diseases and blindness related to vitamin A deficiency. The company, which recently completed a map of all the genes in rice, also is making that research available to other researchers worldwide.

And Zeneca, a British life sciences company, has pledged to provide regulatory, advisory, and research expertise to bring the "golden rice" to developing countries. There are many other examples of industry collaboration with governments and public institutions. Companies are helping to apply market-derived technologies to crops that improve conditions for millions but hold little if any profit potential, such as virus-resistant sweetpotato research in Kenya, virus-resistant papaya in Southeast Asia, and cassava projects in other African nations.

The science academies do not put all the responsibility on private industry. They point out that after World War II, the public sector and charitable foundations financed crop research that led to doubling or tripling of crop yields in Asia and Latin America, along with employment gains and improved nutrition. During what is known as the "Green Revolution," wheat and rice varieties were developed that "met the needs of millions of poor farmers and consumers." Science and technology can continue to make a positive contribution in alleviating world hunger.

U.S. consumers overwhelmingly support initiatives to increase agricultural productivity and the use of biotechnology in addressing concerns of global food and nutritional security. In a recent poll conducted by the Alliance for Better Foods, most (80-90 percent) U.S. consumers surveyed said that they would support using biotechnology to develop

- crops requiring fewer chemicals to protect them from weeds and insects,
- crops that are more productive or that grow in harsh conditions,
- crops that require less land and water to grow the same amount of food,
- foods that are richer in vitamins and nutrients, and
- foods that stay fresh longer without rotting or spoiling.

This survey shows that U.S. consumers are not swayed by the current anti-technology hysteria sweeping elsewhere, and that they strongly believe that responsible application of technology can advance food and nutritional security.

U.S. agriculture is the envy of the world and has made outstanding progress in the past century because of judicious application of technology. Biotechnology represents a frontier advance in agricultural science, and it has far-reaching potential in advancing global food production in an environmentally sustainable manner, continuing to prove Thomas Malthus wrong. We should not be lulled into complacency. While the world population will continue to grow in the developing countries where food is already a problem, biotechnology represents a powerful tool that we can employ in concert with many other traditional approaches in increasing food production in the face of diminishing land and water resources.

Ronald Cantrell of the International Rice Research Institute in the Philippines says "To still have hunger in our world of abundance is not only unacceptable, it is unforgivable." World hunger is a complex issue, one for which there is no one answer. Yet while biotechnology may not be the only solution, it can be a valuable tool in the struggle to feed a hungry world.

Endnotes

1. Encyclopedia Britannica online edition. 2000. [\[Return to text.\]](#)
2. CGIAR International Center for Tropical Agriculture (CIAT) Web site. 2000. [\[Return to text.\]](#)
3. ISAAA. 1997. ISAAA Annual Report 1996: Advancing Altruism in Africa. Ithaca, New York: ISAAA. [\[Return to text.\]](#)
4. William H. Danforth, chairman, Donald Danforth Plant Science Center. 2000. , January 9. [\[Return to text.\]](#)
5. ISAAA. 1997. ISAAA Annual Report 1996: Advancing Altruism in Africa. Ithaca, New York: ISAAA. [\[Return to text.\]](#)
6. Gianessi and Carpenter. 1999. National Center for Food and Agricultural Policy. [\[Return to text.\]](#)
7. ISAAA. 1997. ISAAA Annual Report 1996: Advancing Altruism in Africa. Ithaca, New York: ISAAA; CIAT Web site, 2000. [\[Return to text.\]](#)
8. Becker, Hank. 1999. "Making harvests more nutritious," *Agricultural Research*. May. CIAT Web site, 2000. [\[Return to text.\]](#)
9. Conway, Gordon, president of the Rockefeller Foundation, October 19, 1999. [\[Return to text.\]](#)

10. Wafula, John. 1999. *The Nation* (Nairobi), October 21. [\[Return to text.\]](#)

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