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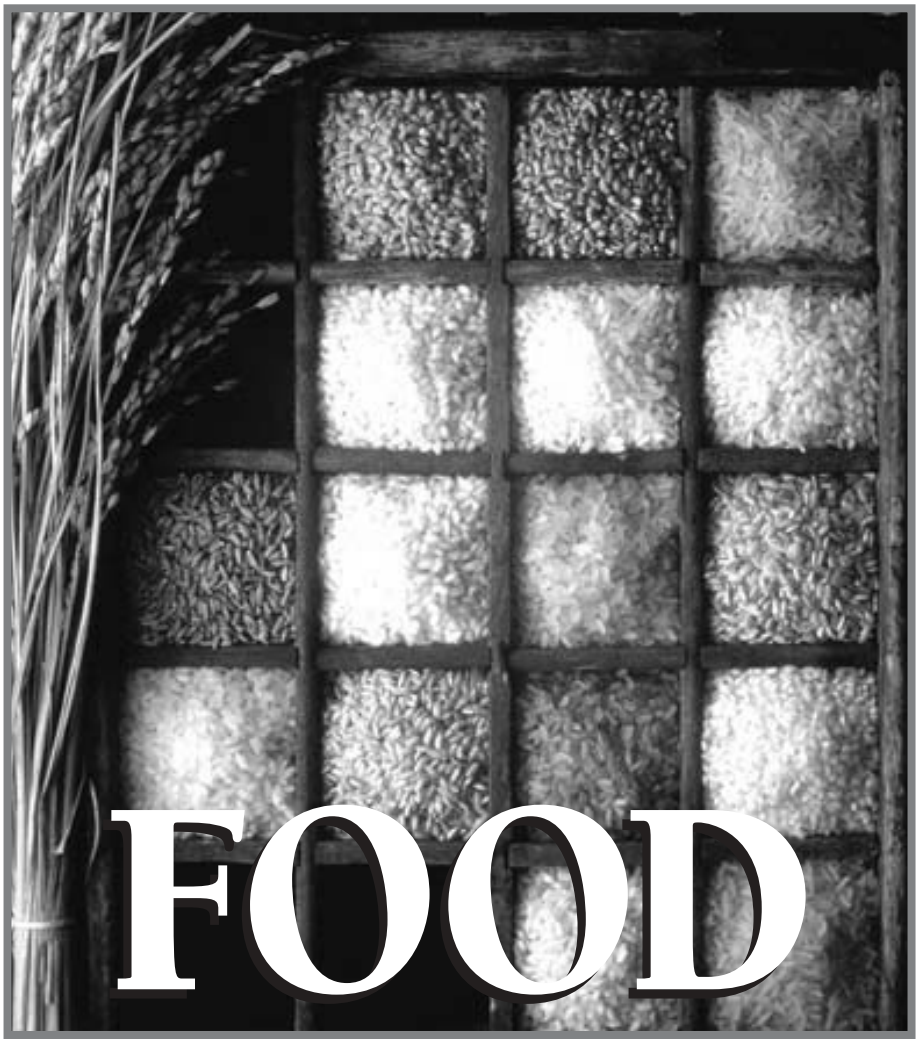

SECURITY AND SAFETY

May 2002

ECONOMIC PERSPECTIVES

Food Security and Safety

U.S. DEPARTMENT OF STATE *ELECTRONIC JOURNAL* *VOLUME 7, NUMBER 2*

With the increased movement of people and goods around the globe, food security — access to adequate and sustainable food supplies — and food safety have become topics of widespread international interest. What is being done to ensure that reliable and affordable amounts of nutritious food are available to the world's growing population and how safe is the global food supply?

Only a small percentage of the world's hungry and malnourished people currently are being reached by food assistance programs, says Congressman Tony Hall, U.S. Ambassador-designate to the United Nations hunger and food organizations, in the lead article in this issue of *Economic Perspectives*. Hasty, stop-gap measures to address food security, he says, must be replaced by programs that are crafted, in part, by key stakeholders in affected communities to ensure predictable and stable food supplies appropriate to local conditions.

Hall and other experts begin by asking if food insecurity is a symptom or a cause of poverty. Hall suggests that hungry people are so focused on getting their next meal they cannot take advantage of many traditional routes out of poverty, such as education and alternative agricultural techniques that would, over the long term, help them attain food security. These experts recommend some new approaches, such as direct food assistance for families whose children stay in school and legal protection for rural property rights that would encourage farmers to make the types of investments that would boost food productivity. Others argue that food insecurity is not an issue of a shortfall in food production but rather that governments have neglected agricultural development, made ineffective use of food aid, and, through protective trade barriers, made hunger alleviation more difficult to attain.

There are success stories. Bangladesh, once extremely dependent on food imports, has transformed its devastated agricultural sector into one of the most productive farm economies in all of South Asia through a global partnership between foreign aid agencies, international research institutions, and indigenous non-governmental organizations. Greater crop diversification would help further food security in Bangladesh, experts say.

Food security and safety are tightly linked. On one hand, transgenic technology may hold the greatest potential to increase food production, reduce the use of harmful chemical pesticides, and provide nutritional foods. On the other hand, some argue that the technology, rather than being a hope, represents a new threat to both the environment and health. Some argue that the U.S. food safety regulatory structure is the best in the world and ensures the safety of both the domestic and export food supply. Others say that as good as this structure is, even more food product labeling is needed to let consumers know which products include or exclude genetically engineered foods and ingredients.

This issue of *Economic Perspectives* does not take sides on all of these issues but aims rather to educate foreign audiences on U.S. policy and on the debate in the United States over food security and safety, raising important questions that policy-makers in each country must address in forming future development and environmental policies.

ECONOMIC PERSPECTIVES

An Electronic Journal of the U.S. Department of State

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ECONOMIC PERSPECTIVES

An Electronic Journal of the U.S. Department of State *Volume 7, Number 2, May 2002*

The Office of International Information Programs of the U.S. Department of State provides products and services that explain U.S. policies, society, and values to foreign audiences. The Office publishes five electronic journals that examine major issues facing the United States and the international community. The journals — *Economic Perspectives*, *Global Issues*, *Issues of Democracy*, *U.S. Foreign Policy Agenda*, and *U.S. Society and Values* — provide statements of U.S. policy together with analysis, commentary, and background information in their thematic areas.

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❑ NEW CHALLENGES IN HUNGER

By Tony Hall, Ambassador-designate to the United Nations Food and Agriculture Organization, World Food Program, and International Fund for Agricultural Development; current Member, U.S. House of Representatives; Chairman of the House Democratic Caucus Task Force on Hunger

Hunger is a cause of poverty, not a symptom of it, says Representative Tony Hall, Ambassador-designate to the United Nations hunger and food organizations. Hall says the world needs to make a stronger commitment to eliminating hunger. He points to promising new anti-hunger programs, such as the Global Food for Education Initiative, and creative public-private partnerships.

Since I first held a dying child in my arms during Ethiopia's 1984-85 famine, the anti-hunger community has mounted a series of remarkable efforts to ensure that such a tragedy never again visits our world. The reaction from policy-makers and the public has been generally supportive, but in recent years experts' responses to the challenge of feeding a growing world population have come under increasing scrutiny.

Despite clear evidence of progress, many engaged in this work were looking beyond immediate problems to the structural obstacles to reaching the goal of ending hunger, and were looking for ways around them. Conventional wisdom was being shaken up, the public was becoming engaged, and approaches shaped by grassroots activists in developed and developing countries alike were getting fresh consideration. The upcoming World Food Summit and the World Summit on Sustainable Development were expected to mark the culmination of this process and the launch of an era of more enlightened and effective action against hunger and poverty.

Then, on September 11, 2001, this chastening and adapting process was transformed — from grist for conferences into a priority task for the United States. Since that horrible day, Americans have gained a new conviction that the needs of suffering people do not deserve neglect, pity, or empty gestures, but effective attention. It is no longer sufficient to merely recognize shortcomings in efforts to ease hunger and other suffering; what matters now is overcoming the hurdles U.S. foreign aid programs face in getting their intended results.

That the terrorists who attacked the United States weren't themselves poor isn't the point; most Americans sense, at a gut level, that misery breeds a contempt that spreads and risks turning others' problems and injustices into our own. The Bush administration has responded with concern about this breeding ground for terrorists. Early in the war it arranged food drops in Afghanistan that, while an imperfect solution, were unprecedented. Most recently, President Bush pledged to increase aid to poor countries significantly. While financial support is critical, money alone can't do this job. The problems of poverty are complex, and even though the lessons we've learned aren't the whole answer, they need to be applied. However tempting, this is not the time for hasty, stop-gap measures, particularly where there is broad consensus on the reforms needed.

For example, the futility of saddling poor countries with interest payments that mushroom into a large drain on the resources they need for future progress is now clear. The push to provide debt relief to some of the world's poorest nations grew out of an initiative mounted by faith groups, which brought the dry subject to life for policy-makers and bystanders alike. While their spark has put success within reach, helping countries avoid falling into the same traps again will take the sustained attention of the United States and other governments, as well as international bodies. This is painstaking work, not a problem to be washed away with one debt-for-nature swap, or a big check, or even a wholesale shift from loans to grants.

Another issue driven by grassroots activists has been the need for justice in trade and environmental responsibility, particularly as both are shaped by the World Bank and the International Monetary Fund. The spotlight they have shone on these problems has exposed faulty assumptions — such as the link between investment and

growth (which isn't always ironclad), or the importance of fiscal discipline (which can be counterproductive when it is excessive or badly timed), or the ability of man to ignore nature (which too often is a short-lived victory). Too often, these and other flaws in how development initiatives are designed have hindered progress; sometimes, they have left communities in an even more precarious position. The lessons learned suggest that early and meaningful involvement of stakeholders and other local people is essential to any project's lasting success.

Statistics add urgency to the relevancy of these lessons for the fight against hunger. Most disturbing is the fact that only 10 percent of the world's hungry and malnourished people currently are being reached by international efforts. The good news is that many of the people being assisted are part of the 6 million who leave the ranks of the hungry each year; the bad news is that, to reach the goals we set for ourselves at the World Food Summit in 1996 — a halving of world hunger by 2015 — four times as many must escape hunger each year.

HOW TO CHANGE OUTCOMES

To change outcomes, we must apply these lessons and rethink our approach to hunger. In the past, it has been seen as a manifestation of poverty, merely a visible symptom of an underlying problem. Viewing hunger instead as poverty's cause not only would mirror the impressions of the poor who are the real experts; it also may trigger a more productive response.

One way to start ending the hunger that nurtures poverty is by recognizing that hungry people don't have the luxury of "the long run." To survive, they need food today and the security of knowing they will be able to feed their families tomorrow. If they must focus on scraping their next meal together, hungry people cannot grab hold of lifelines such as education, or new agricultural techniques, or microcredit assistance. Nor can they escape the diseases that plague their families even when some individuals escape. As a result, instead of risking failure by trying something new, many do what they always did. And, as the saying warns, the result is that they get what they always got: another turn of the vicious cycle of poverty and still more hunger.

The Global Food for Education Initiative, championed by George McGovern, former U.S. ambassador to the U.N. hunger and food organizations, and former U.S. Senator Bob Dole, is a good example of a program that squarely addresses food insecurity. By providing students in developing countries with a solid meal at school (which often represents most of the day's nutrients), it removes one obstacle to attending classes. It is not the whole answer, but it has proven effective — starting in our own country, where school lunch programs begun after World War II exposed a surprising number of Americans who were too stunted by hunger to be capable soldiers. Begun in 2000 with $300 million worth of food, the program is a foreign aid program that can enjoy sustained public support, an attribute that deserves greater respect. Another promising new focus is opening markets to broader participation. Developing countries are demonstrating more willingness to help solve their problems by being active participants in global trade. Millions more people in Africa, Asia, and Latin America could lift themselves from hunger and poverty if unfair practices that shut poor workers out of the international trade system were eliminated. The international community, led by the United States, should continue helping developing countries gain access to new markets and find trade-based, win-win solutions.

And there are tried-and-true approaches, too — from supporting microenterprises, to funding child survival and basic education, to projects that are being adapted to meet the needs of HIV/AIDS sufferers and AIDS orphans. Often, what's needed to make traditional programs effective is simply a stronger commitment to them.

PREVENTION

Another scrap of outdated thinking is the notion that "compassion fatigue" undermines support for anti-poverty work. The problem is not that this is wrong; the problem is that it has resulted in a hair-on-fire approach to fighting hunger that has made "fatigue" a self-fulfilling prophesy.

For example, emergency relief once made up about 30 percent of the World Food Program's work, and famine prevention accounted for 70 percent. In recent years, this has flipped: the dollars to help with irrigation or income projects, which could help people withstand difficult times, instead are going to showy and massive interventions after a crisis begins. Drought, war, and other triggers for these crises are nobody's fault, of course. But the siphoning of funds away from prevention has compounded problems once they begin. The resulting images frustrate even the most generous donors and make

others fed up with what they perceive to be a failure to invest aid dollars more wisely.

Savvy Americans don't expect money to solve all problems, and they do expect to see problems on the news; but they rightly feel that some results of ongoing efforts should be apparent. "What works" may never make breaking news, but those projects are the best hope for the progress that can combat donor fatigue. To be most effective, prevention must begin in rural areas, where 75 percent of those experiencing extreme poverty live and where problems are rife. For example, rural women produce 60 to 80 percent of their countries' food, but own just 2 percent of the land. More needs to be done to strengthen legal frameworks that enable them to protect their property and other rights. Another example: improving agricultural productivity will mean finding ways that don't encroach further on fragile lands or further stress the supply of freshwater resources — but poor families' dependence on farming leaves them little room to experiment with new techniques.

PUBLIC-PRIVATE INITIATIVES

A third way to make the changes needed is to tap the private sector, which has become an emerging, creative force in the past decade. The role played by Microsoft Chairman Bill Gates and his wife Melinda, who have seeded an immunization project with $750 million, of media mogul Ted Turner, who has contributed $1 billion to the United Nations, and of numerous other donors is remarkable and, hopefully, marks the beginning of a more active generation of philanthropists.

This outreach should not stop at funding solicitation, though. Individuals and corporations seem willing to accept new social responsibilities, but they must be engaged more constructively if innovative approaches are to be found. For example, many corporations probably can find common ground with activists on rule-of-law and other issues important both to commerce and civil society. More certainty can help carry activists' messages of the need for governments to be responsive to their people to powerful audiences in ministries that civil society rarely can access.

OLD APPROACHES AREN'T THE ANSWER

For too long, the food needs of a growing population have been answered with an assortment of solutions that tended to ignore cultural, political, and religious factors. Countries and their peoples were expected to adapt to these one-size-fits-all recommendations. Many did, and the results of a generation of work are, on balance, largely positive. But there is an unacceptable danger in accepting results with serious flaws, or congratulating ourselves for progress that touches the lives of just 1 in 10 of the world's hungry.

The attacks on the U.S. embassies in Kenya and Tanzania in 1998 yielded a new generation of structures capable of protecting Americans serving abroad and their colleagues. The attacks in 2001 on our society and our values, which American embassies around the globe symbolize, ought to trigger an equally sweeping redesign of the programs and priorities aimed at the 2 billion people who live on less than a dollar a day.

Starting this work with a fresh determination to relegate hunger to the world's history books would be a promising foundation for promoting sustainable development and ending the desperate need that impoverishes us all. ❑

❑ ENSURING SAFE FOOD

By Sally L. McCammon, Science Advisor, Animal and Plant Health Inspection Service, U.S. Department of Agriculture

The U.S. government, with more than 16 years' experience in evaluating biotechnology products, has instituted the most thorough and scientifically-based regulatory system anywhere in the world, says Sally McCammon, chief scientist with the U.S. Department of Agriculture's Animal and Plant Health Inspection Service. McCammon outlines the roles played by key U.S. regulatory agencies and their approach to food safety and to ensuring that the most current scientific information is available to those regulatory bodies before any genetically engineered product is released in the U.S. market.

Few food issues have raised as much interest, particularly internationally, as has the safety of genetically engineered foods. And few foods have been as thoroughly examined, dissected, tested, and regulated. The fact is that genetically modified foods developed in the United States have gone through the most intense regulatory and scientific review that exists anywhere in the world and would not be found in the U.S. marketplace unless regulators were completely convinced about their safety. This article reviews the U.S. regulatory process and the key agencies responsible for the safety of the U.S. food supply and, consequently, U.S. food exports.

THE U.S. REGULATORY FRAMEWORK

In 1986 the White House issued the Coordinated Framework for the Regulation of Products of Biotechnology, proactively establishing a strong commitment by the U.S. government to the safe development of biotechnology products from the laboratory, through field-testing and development, and into the marketplace. Over the last 16 years, the United States has gained considerable experience in evaluating the products of biotechnology for safety. The framework's underlying assumption is that the risks from the products of biotechnology are the same in kind as those of similar products — risks to agriculture, the environment, and human health. Thus, existing U.S. laws and regulations for addressing these risks have been deemed adequate to address any risks posed by products developed using biotechnology, and no new "gene law" has been considered necessary.

To assure safety, the U.S. regulatory structure is based on risk rather than process, and its success is due to the fact that regulatory agencies with established credibility and expertise evaluate these products. Many aspects are evaluated when determining safety. Regulations establish procedures and criteria by which different types of products are evaluated, including those produced using biotechnology, products such as vaccines, plant varieties for food, pesticides, animal products, and pharmaceuticals. Certain products of modern biotechnology can easily be assessed under existing regulations, while other products require new regulations.

The U.S. regulatory agencies that examine plants and plant products intended for use as food are the Environmental Protection Agency (EPA), the Food and Drug Administration (FDA) of the Department of Health and Human Services, and the Animal and Plant Health Inspection Service of the U.S. Department of Agriculture (USDA-APHIS). A new genetically engineered plant could be reviewed by one or all three of these agencies, depending on the plant and trait engineered into it. For instance, a *Bacillus thuringiensis* (Bt) gene in a food crop would be reviewed by USDA-APHIS, EPA, and FDA; a plant with modified oil content for food would be reviewed by FDA and USDA-APHIS; and modified flower color in a horticultural crop would be reviewed by USDA-APHIS alone. It can take five years of field-testing, under USDA-APHIS oversight, for the developer of a new plant variety to evaluate the new line and to collect the data needed to pass through the regulatory system. Another two years may be needed for USDA-APHIS, EPA, and/or FDA to complete their reviews. Multiple agencies reviewing the same product from different perspectives provide a comprehensive system for assuring safety.

The United States has built upon its experience using a science-based approach to evaluating other products to evaluate the products of modern biotechnology. Science-based means that the review of the product is done using scientific criteria relevant to that product. The approach is constantly evolving due to new types of products and the availability of new scientific information. Science is

the basis by which regulatory officials can assure and build upon credibility, remain current, and assure a rational basis for decision-making. Science and the legal processes are inextricably linked for regulations that evaluate biological products.

THE REGULATORS' ROLES

Under the authority of the Plant Protection Act, USDA-APHIS regulates the development and field-testing of genetically engineered plants, microorganisms, and certain other organisms. USDA-APHIS regulations provide procedures for obtaining permission to release (field-test), import into the country, or move interstate within the United States. After several years a developer may petition USDA-APHIS for non-regulated status. The USDA-APHIS review process evaluates agricultural and environmental safety issues. Particular attention is paid to evaluating any changes in agronomic characteristics of the new plant line. Although usually not related to the change intended, such unintended changes could impact food safety as well as agricultural and environmental safety. Fortunately, over 98 percent of these "off-types" are discarded by developers early in the development process. Only the healthiest and well-characterized lines survive the selection in the subsequent development process and are sent to regulators for evaluation.

To date 53 petitions have been granted and almost 8,000 permits and notifications issued for field-testing at almost 30,000 sites. Although no petitions have been denied, 21 have been withdrawn due to insufficient information or other inadequacies in the application.

Under the Federal Food, Drug, and Cosmetic Act (FFDCA), EPA sets tolerance limits for substances used as pesticides on and in food and feed, or establishes an exemption from the requirement of a tolerance if such a tolerance is not necessary to protect the public health (determined after evaluation by the agency). EPA's responsibility is to ensure the safety of pesticides, both chemical and biological, under the authority of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) by regulating the distribution, sale, use, and testing of plants and microbes producing pesticidal substances. Both EPA and USDA-APHIS review many transgenic plants for agricultural and environmental effects.

EPA issues experimental use permits for field-testing of "pesticidal" plants and registrations for commercialization of these plants. The Bt toxin, which occurs naturally in soil bacterium, is considered a biological pesticide. For plants containing Bt toxin, the manufacturer must prepare a resistance management plan as a condition for registration with the EPA. The plan describes how the manufacturer registering the plant product will assure that resistance does not build up in affected insect populations and reduce the effectiveness of Bt applied topically or used through the plant's genetics. EPA also evaluates the new use of herbicides on herbicide-tolerant transgenic plants while USDA-APHIS evaluates the herbicide-tolerant plant.

FDA assesses the food (including animal feed) safety and nutritional aspects of new plant varieties as part of a consultation procedure published in the 1992 *Statement of Policy: Foods Derived From New Plant Varieties.* FDA expects developers of new plant varieties to consult with the agency on safety and regulatory questions under the authority of the FFDCA. FDA policy is based on existing food law and requires that genetically engineered foods meet the same rigorous safety standards as are required of all other foods. The FDA biotechnology policy treats substances intentionally added to food through genetic engineering as food additives if they are significantly different in structure, function, or amount from substances currently found in food. Many of the food crops currently being developed using biotechnology do not contain substances that are significantly different from those already in the diet and thus do not require pre-market approval.

Although the FDA system currently is voluntary, every new plant line that is commercialized in the United States has been evaluated by the FDA through this consultation process. In public meetings held in 2000 no concerns with the substance of the FDA review were voiced for those products already reviewed by FDA. In 2001 FDA proposed to make this review mandatory, and it is currently studying the almost 100,000 comments received before finalizing this rule.

The FDA's assessment includes evaluating the composition of major nutrients and levels of toxicants that many plants produce naturally, and determining potential for allergenicity, particularly assessing whether the inserted genes are from allergenic sources. Also evaluated is whether a new method of food preparation must be used as a result of the genetic change, or whether the food is changed so that it is unrecognizable. The food

safety issues addressed assess whether the food is safe and wholesome.

If there is any material change to the food, then labeling is required. Labeling of food in the United States must be truthful and not misleading. To provide guidance to developers of food involving genetic engineering, the FDA also provided draft guidance in 2001 on *Voluntary Labeling Indicating Whether Foods Have or Have Not Been Developed Using Bioengineering.*

Transparency is built into the U.S. system at every step, beginning with the initial passage of laws by Congress, and public input is important to assuring that concerns are addressed. Regulations developed to implement these laws consider all public comments before the regulations are finalized. Public comment is also invited for decision documents such as environmental assessments and future evaluations. Comprehensive field-tests, petition databases, and U.S. regulations and regulatory decisions are accessible at http://www.aphis.usda.gov.

A SCIENCE-BASED REGULATORY APPROACH

Science informs the decision-making process of U.S. regulators at many levels. Regulators evaluating specific products use the available published scientific literature, particularly from peer-reviewed journals. Applicants cite this literature in their applications for regulatory approval. The U.S. National Academy of Sciences (NAS) or other parts of the scientific enterprise may be asked to identify the scientific issues and recommend approaches to evaluating particular types of products. Meetings of scientists can be called to address specific issues, as have past meetings on Bt, viral recombination, and relevant biological factors for evaluating crop plants. Information can even be requested on specific products. The EPA meets with its scientific advisory panels. The FDA refers questions to its Food Advisory Committee. Recently, the NAS reviewed the scientific underpinnings of the regulatory decisions made by USDA. The USDA also has a Risk Assessment Grants Program that specifically funds research on emerging issues with genetically engineered organisms. Regulators use all of this information to assure that the most current approaches and information are available to inform regulatory decisions.

CODEX ALIMENTARIUS

Internationally, the appropriate scientifically based standards, guidelines, and recommendations for evaluating the food safety of transgenic products as they move into the international marketplace are being developed by the representatives of national governments in the ad hoc Intergovernmental Codex Task Force on Foods Derived From Biotechnology under the Codex Alimentarius. The first international *Guideline for the Conduct of Food Safety Assessment of Foods Derived from Recombinant-DNA Plants* as well as the *Principles for the Risk Analysis of Foods Derived from Modern Biotechnology* , both currently in draft status, are slated for adoption in 2003 by the Codex Alimentarius Commission. These standards are a milestone in agreement on the approaches to assuring food safety of the products of modern biotechnology. ❑

❑ FOOD AND AGRICULTURE IN BANGLADESH: A SUCCESS STORY

By Gordon West, Deputy Assistant Administrator, Asia and Near East Bureau, United States Agency for International Development

Bangladesh's thriving agricultural sector, benefitting from a new global partnership between the people of Bangladesh and foreign aid agencies, international research institutions, and nongovernmental organizations, has become a South Asian success story. Further agricultural gains realized through greater crop diversification, free market policies, investments in seed research and irrigation, infrastructure developments, and new approaches to food aid have helped move the country to a position of near self-sufficiency in rice, its main crop.

The views expressed herein are those of the author and do not necessarily reflect the views, opinions, or ideas of the U.S. government, the U.S. Agency for International Development (USAID), its management, or those serving within the agency's Asia and Near East Bureau.

Bangladesh's accomplishments in transforming its devastated agricultural sector into one of the most productive farm economies in all of South Asia is a major development success story. Once racked by famine and dependent on food imports, the country is now essentially self-sufficient in rice, is emerging as a significant exporter of high-value agricultural products, and enjoys the second highest percentage growth in per capita income in South Asia. Its success is largely a story of close cooperation between the government of Bangladesh and its peoples with foreign aid agencies, international research institutions, and indigenous nongovernmental organizations.

THE ECONOMY OF BANGLADESH

Bangladesh has a population of 131 million — about 1,007 persons per square kilometer. Almost 26 percent of its gross domestic product (GDP) comes from agriculture, including fisheries, which also accounts for more than 13 percent of its export earnings. Over 70 percent of the population is directly engaged in farming or related activities.

Within the past few years, Bangladesh has reached self-sufficiency in its main cereal, rice. Rice production increased from 11.7 million metric tons in 1974 to 23.1 million tons in 2000, an average annual increase of 3.6 percent. Wheat production climbed from 0.11 million metric tons in 1974 to 1.8 million metric tons in 2000. Cereal prices are low and stable, and production continues to increase. The economy also is showing rapid diversification, particularly in the livestock and poultry sectors.

Agricultural exports, both bulk commodities and higher-valued processed products, grew by nearly 5 percent over the last five years. In 2000, the value of shrimp exports alone was $296.3 million. And unlike the garment industry, where the bulk of the export earnings go back out of the country to pay for imported raw materials and machinery, with agribusiness the value added stays in the country.

AGRICULTURAL RESEARCH

Much of the success in Bangladesh's agricultural sector can be attributed to the development and implementation of dry-season irrigated rice. Thirty years ago, almost all of Bangladesh's cereal production was from the monsoon crop. Now almost half is dry season, made possible by the development and release by the public research institutions of high-yielding rice varieties adapted to shorter days and cooler temperatures.

The introduction of this rice was aided by the decision of the Bangladesh government not to intervene in the market. Prices reflected market forces, and the private sector imported pumps to irrigate dry-season crops. The fertilizer system was privatized, resulting in a tripling in the use of fertilizer in 10 years. Bangladesh farmers took the challenge by planting and irrigating the new high-yield seed. The entire rural population has benefited: peasant farmers now get two or even three crops per year, and landless peasants find that their income-earning possibilities have expanded. It was through publicly supported agricultural research working in tandem with private investment for irrigation that made the jump in rice production possible.

Similarly, organizations like the International Rice Research Institute (IRRI) and the International Maize and Wheat Improvement Center (CIMMYT) collaborated with Bangladesh's agricultural research system to introduce more sustainable and efficient rice, wheat, and maize cropping systems into Bangladesh.

ADOPTING FREE MARKET POLICIES

Bangladesh's decision, supported by the U.S. Agency for International Development, to liberalize its food import policy is another important side to the country's success story. The government has removed many agricultural subsidies, eliminated quantitative restrictions, reduced tariff levels, and created an open-market economy that makes agricultural inputs readily available for farmers and guarantees fair commodity prices. Today, Bangladesh's agricultural sector is the most open and least subsidized of South Asia.

One of the keys to this success has been the decision by the government to liberalize the import of food. Over the last 10 years, private traders have stepped in to import food grains during times of domestic shortfall, often driven by floods. These actions by private traders have provided both supply and price stabilization and have removed a major financial burden from the government. During fiscal year 1999, private sector food imports to address needs arising from the 1998 flood reached 2.26 million metric tons, mainly from India. Had the government of Bangladesh imported this grain itself, the total fiscal cost would have been about $185 million. The private sector's share in food imports climbed from zero in 1991 to 50 percent in 1996 and 100 percent in 2000.

The government of Bangladesh also reoriented its large public food distribution system away from mass distribution in favor of a targeted food "safety net" program for the poor. In fiscal year 2000, 85 percent of public food was targeted for the poor, an increase of about 46 percent over 1992.

INFRASTRUCTURE DEVELOPMENT

One of the major roles played by foreign development agencies in Bangladesh has been the financing of rural infrastructure, which has made it easier to move products from field to market. During 1995-2000, U.S. financing helped rehabilitate over 15,000 kilometers of farm-to-market roads, creating jobs and improving year-round access to markets and to basic human development services. The cost of food transportation has dropped, and freight traffic has increased 94 percent.

Foreign financing also facilitated efforts to improve water flow, which led to a quicker recession of floodwaters and a subsequent 16 percent increase in agricultural production — by value — in the affected areas.

Rural electrification, aided by funding from foreign aid agencies, has been another important factor in the agricultural productivity gains. During 1977-2000, nearly 2.42 million domestic connections were provided and over 80,000 irrigation pumps electrified. The 57 local electric cooperatives now reach over 20 million rural people. Crop yields are up in electrified villages, as are both the number of agricultural jobs and the wages received by agricultural labor. The rural electrification program has a 95 percent rate on collection of payments, compared to only 60 percent nationwide.

A GLOBAL PARTNERSHIP

Food security and safety in Bangladesh benefited from the effort of global partnerships. USAID and the U.S. Department of Agriculture provide wheat, which is sold on the Bangladeshi market for local currency. Funds raised from the sale of grain are allocated to local development activities, and the government of Bangladesh uses food grain monetization for its social safety net activities. One specific program provides a food provision to poor families when they send their children to school rather than to work. This Food for Education program increases overall educational levels, decreases child labor, and provides food to poor families.

Under the local development programs, men and women in the most food-insecure areas in Bangladesh are given the opportunity to work for a wage and/or food through programs administered by CARE and World Vision. These programs improve the rural infrastructure and increase community assets by building environmentally sound, all-season roads. Program participants also plant trees to prevent soil erosion, and poor women are employed to care for the trees.

Similarly, the United Nation's World Food Program (WFP) has provided food assistance for nearly 3 million Bangladeshis. Some of these receive WFP rations as payment for their efforts to reclaim rural roads, community fishponds, plantations, and flood-protection embankments.

CHALLENGES AHEAD

While there have been impressive successes in Bangladesh, important challenges remain. Rates of malnutrition in the country are among the highest in the world, and nutritional standards are poor. Production from dry season farming is leveling off, in large part due to problems of scale — farms are simply too small to make possible or feasible the kind of capitalization necessary to bring about further significant increases in yields.

A further transformation of Bangladeshi agriculture, mostly in terms of diversifying into higher value products such as maize, legumes, livestock, and vegetables, both for domestic and export markets, is the next logical step for the country. Rice uses four or more times more water than crops like wheat and maize, and the lack of adequate water will be a major impediment to future agricultural productivity. Also, Bangladeshi diets lack essential amino acids, fats and minerals, and vitamins. By making products such as wheat, fruits, milk, pulses, and meats widely available at affordable prices, it would help improve overall health.

The good news is that there are no major obstacles to diversification and there are a host of new seeds to address a broad range of environmental challenges. The close cooperation between the government of Bangladesh, the research institutions, and international development agencies suggest that Bangladesh can move beyond self-sufficiency and that agriculture and agribusiness are going to remain the bedrock of Bangladesh's economy for years to come. ❑

GLOBAL FOOD SECURITY

By G. Edward Schuh, Regents Professor of International Economic Policy, University of Minnesota

Governments have neglected agricultural development, used food aid ineffectively, and failed to capitalize on international trade to ensure food security, says G. Edward Schuh, Regents Professor of International Economic Policy at the University of Minnesota. He adds that modernization of agriculture will contribute greatly to alleviating poverty and, thus, promote food security. Schuh also is the Orville and Jane Freeman Professor of International Trade and Investment Policy at the University of Minnesota and co-chair of the U.S. Food Security Advisory Committee.

From June 10 to 13, leaders from nations around the world will meet in Rome at the World Food Summit plus 5 to discuss the progress made since the original World Food Summit some five years ago. The results will not be particularly pleasing, since progress is not as great as was expected.

In my view, three issues have contributed to the poor performance in reducing food insecurity in the recent past: (1) the neglect of agricultural development both by governments in developing countries and by the international donor community, (2) the ineffective use of food aid, and (3) the failure to capitalize on international trade as a means to ensure food security.

A basic premise of my thinking is that food security is a poverty problem — the lack of food is due to the lack of the means to acquire it. It is not, in general, due to a shortfall in food production. This is the familiar finding of Nobel laureate Amartya Sen from his studies of famines in China and India.

Another point useful in understanding this analysis is that food security problems can be of a short-term or a long-term nature. In other words, people may suffer either from short-term fluctuations in their incomes, or they may suffer chronically from low per capita incomes. The policy prescriptions for these two problems are quite different.

LACK OF ATTENTION TO AGRICULTURAL DEVELOPMENT

Both the governments in developing countries and the international development community have in recent years sorely neglected agriculture as a component of their programs for economic development. This neglect reflects an enormous institutional memory loss: back in the 1960s and 1970s such neglect would have been unheard of.

The apparent logic behind this neglect appears to rest on two perceptions. First, observers of the development scene note that as an economy grows and per capita incomes rise, the share that agricultural employment makes up of total employment declines, as does the share that agricultural gross domestic product (GDP) makes up of total GDP. They conclude from such trends that agriculture declines in importance as economic development proceeds, so one can neglect the agricultural sector.

The difficulty with that argument can be seen by considering the modernization of the production of staple foods by the introduction of new production technology into the sector as the basis for agricultural modernization and development. Staple commodities tend to have low price elasticity of demand, with the result that the introduction of new production technology to the sector will result in a lower price for the staple, other things being equal. That decline in real prices will be equivalent to an increase in real per capita incomes for consumers. This points to the ultimate importance of agriculture in the development process. It is important because everybody consumes food.

The contribution from modernizing the production of food staples does not stop there, however. It turns out that poor-income groups benefit in a relative sense from the modernization of agriculture, in part because low-income groups spend a larger share of their income on food than do middle- and upper-income groups. It is difficult to find a sector of the economy in which the benefits of the

development process will be spread as widely as in the case of agriculture, and so much in favor of the poor.

Similar arguments can be made about the modernization of tradable agricultural commodities. In this case, the price of the commodity does not decline with modernization. However, the sector becomes more competitive in the international economy, and the net result is either an increase in export earnings or an increase in savings of foreign exchange earnings. The benefits will again be widely distributed in the domestic economy, since the foreign exchange can be used either to service international debt or to finance higher rates of economic growth and development.

There is a certain irony in the finding that food insecurity is not due to shortfalls in food production, but that the modernization of agriculture has such an important role to play in alleviating food insecurity. The explanation for what to some might appear to be an anomalous result is that agriculture can be a key to more general economic development of the economy. To be even more specific, the modernization of agriculture contributes to widespread distribution of the benefits of modernization to consumers, with those benefits distributed in a relative sense in favor of the poor.

INAPPROPRIATE USE OF FOOD AID

Food aid is one component of foreign aid that continues to garner ample political support in the developed countries. That support reflects in part the strong political constituencies in the agricultural sectors of the developed countries. It also reflects an appreciation of the direct benefits of food aid to its ultimate beneficiaries.

Of course, food aid is not without its problems. Academics such as Nobel laureate Theodore W. Schultz and others were at one time fairly critical of food aid, largely on the grounds that it had strong disincentive effects for poor producers. At one time those critics made substantial progress in addressing these problems, and much care was exercised in how the food aid was introduced into the economy of the recipient country.

Later, however, the lexicon of foreign aid was enriched with the addition of a new word and concept — "monetization." This new concept referred to the sale of the food aid in the market for cash, which in turn was used for fiscal purposes in general economic development programs. Regrettably, monetization quickly became popular in the new lexicon, and disincentive effects soon disappeared as an issue of concern. One hardly hears the term disincentive effects mentioned in today's policy debates, and monetization has rapidly conquered the day.

Again, there is a serious side to this problem. The political support for monetization comes largely from nongovernmental organizations (NGOs), which still depend heavily on food aid for their financial resources. Their support for food aid and for monetization is obvious. Their livelihood depends on it — never mind the consequences for the poor farmer.

The point to be emphasized is that there are other means of making more effective use of the food aid, and we need to move in those directions. One such approach is to use the food aid to pay the families of school-age children to send their children to school. This will introduce the food aid into the economy as an increase in income to very poor families. In so doing, the disincentive effect will be minimal.

At the same time, children of low-income families are seldom able to go to school, largely because they are needed to earn the income needed to support the family. In rural areas, these children typically work on the farm. In urban areas, such children typically beg on the street corners or sell apples or pencils. In either case, the families need the income the child earns to survive.

The use of food aid to "pay" the family to send the child to school has multiple contributions. The disincentive effects are minimal. The child is able to go to school, thus increasing educational attainment. The health and nutrition of the family is improved. And the per capita income of the family is improved.

THE NEGLECT OF INTERNATIONAL TRADE

International trade can be an important means to promote economic development. The sectoral specialization and division of labor it makes possible lead to increases in per capita incomes. Moreover, it eliminates the limit on economic growth and development that is so characteristic of small countries. Despite the progress of globalization and the growth in international trade in general, protectionism continues to be a problem, especially in the global agricultural sector.

The United States and the European Union are especially protective of their agricultural sectors. Moreover, these

countries continue to make effective use of dumping policies, in the form of food aid and in the form of export subsidies — both explicit and implicit.

The developed countries are not alone in having weak economic policies for their agricultural sectors, however. They discriminate against their agriculture by shifting the domestic terms of trade against their agricultural sectors. This leads to premature migration from agriculture and the rapid urbanization of domestic economies that one sees all around the world. The result is a failure to take advantage of the contribution that international trade can make in bringing about balance in the flow of exports and imports, and thus to address the basic food security problem through international trade.

CONCLUDING COMMENTS

Progress will be made in addressing the global food security problem only as progress is made in alleviating global poverty. Poverty, in turn, will be alleviated only as agriculture is modernized and the benefits of that modernization are realized through the liberalization of trade policies and the opening of national economies. Although increased food production is not the means to alleviate food insecurity problems directly, the modernization of agriculture can contribute mightily in alleviating poverty on a global scale. ❑

Note: The opinions expressed in this article do not necessarily reflect the views or policies of the U.S. Department of State.

BATTLING HUNGER WITH BIOTECHNOLOGY

By Gregory Conko, Director of Food Safety Policy, Competitive Enterprise Institute, and C.S. Prakash, Professor of Plant Molecular Genetics, Tuskegee University.

Needless restrictions on agricultural biotechnology would harm the world's ability to battle hunger in the 21st century, say Gregory Conko and C.S. Prakash, co-founders of the AgBioWorld Foundation. They say that the concerns of anti-biotechnology campaigners simply are not supported by the scores of peer-reviewed scientific reports or data from tens of thousands of field trials.

The AgBioWorld Foundation is a nonprofit organization that provides information to the general public about developments in plant science, biotechnology, and sustainable agriculture.

During the coming decades the world will face the extraordinary challenge of conquering poverty and achieving genuine food security with a very potent new tool: agricultural biotechnology. Skeptics argue that transgenic plants represent a vast new threat to both the environment and human health. However, that view is not supported by the overwhelming weight of scientific evidence that has been generated over the last three decades. Furthermore, such criticism ignores the fact that needless restrictions on biotechnology could endanger our ability to battle hunger in the 21st century.

Transgenic technology holds the potential to increase food production, reduce the use of synthetic chemical pesticides, and actually make foods safer and healthier. These advances are critical in a world where natural resources are finite and where one-and-a-half billion people suffer from hunger and malnutrition. Already, farmers in the United States, Canada, and elsewhere have benefited from improvements in productivity and reduced use of synthetic pesticides. But the real future of biotechnology lies in addressing the special problems faced by farmers in less developed nations.

Critics like to dismiss such claims as nothing more than corporate public relations puffery. However, while most commercially available biotech plants were designed for farmers in the industrialized world, the increasing adoption of transgenic varieties by developing countries over the past few years has been remarkable. According to the International Service for the Acquisition of Agri-Biotech Applications (ISAAA), farmers in less developed countries now grow nearly one-quarter of the world's transgenic crops on more than 26 million acres (10.7 million hectares), and they do so for many of the same reasons that farmers in industrialized nations do.

PRODUCTIVITY GAINS FROM TRANSGENIC CROPS

Among the most important limiting factors in developing world agricultural productivity is biotic stress from insects, weeds, and plant diseases. Transgenic modifications common in several industrialized nations target these same problems and can be easily transferred into local varieties to help poor farmers in the developing world. For example, South African farmers are already growing transgenic pest-resistant maize, and this year began planting transgenic soy. South African and Chinese farmers have been growing transgenic insect-resistant cotton for several years, and the Indian government approved it for commercial cultivation in the spring of 2002. This transgenic cotton, similar to the varieties so popular in the United States, is expected to boost yields by 30 percent or more for Indian farmers, according to a recent article in the *Economic Times*. It could even transform India from the world's third largest producer of cotton into the largest.

Globally, transgenic varieties are now grown on more than 109 million acres (44.2 million hectares) in Argentina, Australia, Canada, Chile, China, Mexico, South Africa, and the United States, according to ISAAA. They are even grown on substantial amounts of acreage in Brazil, where no transgenic varieties have yet been approved for commercial cultivation. Farmers there looked across the border and saw how well their Argentine neighbors were doing with transgenic varieties, and smuggling of transgenic soybean seed became rampant. The European Union's (EU) Directorate General for Agriculture estimates that Brazil is now the fifth largest grower of transgenic crops.

MEETING ENVIRONMENTAL GOALS

Although this first generation of crops was designed primarily to improve farming efficiency, the environmental benefits these crops offer are extensive. The U.S. Department of Agriculture found that U.S. farmers growing transgenic pest-resistant cotton, maize, and soy reduced the total volume of insecticides and herbicides they sprayed by more than 8 million pounds per year. Similar reductions have been seen in Canada with transgenic rapeseed, according to the Canola Council of Canada.

In less developed nations where pesticides are typically sprayed on crops by hand, transgenic pest-resistant crops have had even greater benefits. In China, for example, some 400 to 500 cotton farmers die every year from acute pesticide poisoning. A study conducted by researchers at Rutgers University in the United States and the Chinese Academy of Sciences found that adoption of transgenic cotton varieties in China has lowered the amount of pesticides used by more than 75 percent and reduced the number of pesticide poisonings by an equivalent amount. Another study by economists at the University of Reading in Britain found that South African cotton farmers have seen similar benefits.

The reduction in pesticide spraying also means that fewer natural resources are consumed to manufacture and transport the chemicals. Researchers at Auburn University and Louisiana State University in the United States found that, in 2000 alone, U.S. farmers growing transgenic cotton used 2.4 million fewer gallons of fuel, 93 million fewer gallons of water, and were spared some 41,000 10-hour days needed to apply pesticide sprays.

Transgenic herbicide-tolerant crops have promoted the adoption of farming practices that reduce tillage or eliminate it altogether. Low-tillage practices can decrease soil erosion by up to 90 percent compared to conventional cultivation, saving valuable topsoil, improving soil fertility, and dramatically reducing sedimentation in lakes, ponds, and waterways.

The productivity gains generated by transgenic crops provide yet another important environmental benefit: they could save millions of hectares of sensitive wildlife habitat from being converted into farmland. The loss and fragmentation of wildlife habitats caused by agricultural development in regions experiencing the greatest population growth are widely recognized as among the most serious threats to biodiversity. Thus, increasing agricultural productivity is an essential environmental goal, and one that would be much easier in a world where agricultural biotechnology is in widespread use.

Opponents of biotechnology argue that organic farming can reduce pesticide use even more than transgenic crops can. But as much as 40 percent of crop productivity in Africa and Asia and about 20 percent in the industrialized countries of North America and Europe are lost to insect pests, weeds, and plant diseases. Organic production methods would only exacerbate those crop losses. There is no way for organic farming to feed a global population expected to grow to 8 or 9 billion people without having to bring substantially more land into agricultural use.

Fortunately, many transgenic varieties that have been created specifically for use in less developed nations will soon be ready for commercialization. Examples include insect-resistant rice varieties for Asia, virus-resistant sweet potato for Africa, and virus-resistant papaya for Caribbean nations. The next generation of transgenic crops now in research labs around the world is poised to bring even further productivity improvements for the poor soils and harsh climates that are characteristic of impoverished regions.

Scientists have already identified genes for resistance to environmental stresses common in tropical nations, including tolerance to soils with high salinity and to those that are particularly acidic or alkaline. Other transgenic varieties can tolerate temporary drought conditions or extremes of heat and cold.

ENSURING WORLDWIDE FOOD SECURITY

Biotechnology also offers hope of improving the nutritional benefits of many foods. Among the most well known is the variety called “Golden Rice,” genetically enhanced with added beta carotene, which is converted to vitamin A in the human body. Another variety developed by the same research team has elevated levels of digestible iron.

The diet of more than 3 billion people worldwide includes inadequate levels of essential vitamins and minerals, such as vitamin A and iron. Deficiency in just these two micronutrients can result in severe anemia, impaired intellectual development, blindness, and even death. And even though charities and aid agencies such as the United Nations Childrens’ Fund and the World

Health Organization have made important strides in reducing vitamin A and iron deficiency, success has been fleeting. No permanent effective strategy has yet been devised, but Golden Rice may finally provide one.

Importantly, the Golden Rice project is a prime example of the value of extensive public sector and charitable research activities. The rice's development was funded mainly by the New York-based Rockefeller Foundation, which has promised to make the rice available to poor farmers at little or no cost. It was created by scientists at public universities in Switzerland and Germany with assistance from the Philippines-based International Rice Research Institute (IRRI) and from several multinational corporations.

Golden Rice is not the only example. Scientists at publicly funded, charitable, and corporate research centers are developing such crops as cassava, papaya, and wheat with built-in resistance to common plant viruses; rice that can more efficiently convert sunlight and carbon-dioxide for faster growth; potatoes that produce a vaccine against hepatitis B; bananas that produce a vaccine against cholera; and countless others. One lab at Tuskegee University is enhancing the level of dietary protein in sweet potatoes, a common staple crop in sub-Saharan Africa.

Admittedly, experts recognize that the problem of hunger and malnutrition is not currently caused by a global shortage of food. The primary causes of hunger in recent decades have been political unrest and corrupt governments, poor transportation and infrastructure, and, of course, poverty. All of these problems and more must be addressed if we are to ensure real, worldwide food security. But producing enough for 8 or 9 billion people will require greater yields in the regions where food is needed most, and transgenic crops are good, low-input tools for achieving this.

ELIMINATING NEEDLESS RESTRICTIONS

Although the complexity of biological systems means that some promised benefits of biotechnology are many years away, the biggest threat that hungry populations currently face are restrictive policies stemming from unwarranted public fears. Although most Americans tend to support agricultural biotechnology, many Europeans and Asians have been far more cautious. Anti-biotechnology campaigners in both industrialized and less developed nations are feeding this ambivalence with scare stories that have led to the adoption of restrictive policies. Those fears are simply not supported by the scores of peer-reviewed scientific reports or the data from tens of thousands of individual field trials.

Mankind has been modifying the genetic makeup of plants for thousands of years, often in ways that could have had adverse environmental impacts and that routinely introduced entirely new genes, proteins, and other substances into the food supply. Food-grade tomatoes and potatoes are routinely bred from wild varieties that are toxic to human beings, for example. But plant breeders, biologists, and farmers have identified methods to keep potentially dangerous plants from entering the food chain.

The evidence clearly shows there is no difference between the practices necessary to ensure the safety of transgenic plants and the safety of conventional ones. In fact, because more is known about the genes that are moved in transgenic breeding methods, ensuring the safety of transgenic plants is actually easier. But the public's reticence about transgenic plants has resulted in extensive regulations that require literally thousands of individual safety tests that are often duplicative and largely unnecessary for ensuring environmental protection or consumer safety. In the end, over-cautious rules result in hyperinflated research and development costs and make it harder for poorer countries to share in the benefits of biotechnology.

Perhaps more importantly, restrictions on transgenic plants and onerous labeling requirements for biotech foods have caused many governments to block commercialization — not out of health or environmental concerns but because of a legitimate fear that important European markets could be closed to their exports. As last year's *United Nations Development Report* acknowledged, opposition by European consumers and very strict legal requirements in European Union member nations have held back the adoption of transgenic crops in underdeveloped nations that need them.

Furthermore, the Cartagena Protocol on Biosafety, adopted in January 2000, will tend to reinforce these counterproductive policies because it permits governments to erect unwarranted restrictions based on the Precautionary Principle, the notion that even hypothetical risks should be enough to keep new products off the market, regardless of their potential benefits. Thus, EU nations can restrict imports of

transgenic crops from both industrialized and less developed nations, no matter how much scientific data have been presented showing them to be safe, because opponents can always hypothesize yet another novel risk.

Admittedly, advocates have to take the public's concerns more seriously. Better sharing of information and a more forthright public dialogue are necessary to explain why scientists are confident that transgenic crops are safe. No one argues that we should not proceed with caution, but needless restrictions on agricultural biotechnology could dramatically slow the pace of progress and keep important advances out of the hands of people who need them. This is the tragic side effect of unwarranted concern.

AN IMPORTANT DEVELOPMENT TOOL

Ultimately, biotechnology is more than just a new and useful agricultural tool. It could also be a hugely important instrument of economic development in many poorer regions of the globe. By making agriculture more productive, labor and resources could be freed for use in other areas of economic growth in nations where farming currently occupies 70 or 80 percent of the population. This, in turn, would be an important step in the journey toward genuine food security.

The choice is clear. Innovators must proceed with due caution. But as a report jointly published by the United Kingdom's Royal Society, the National Academies of Science from Brazil, China, India, Mexico, and the United States, and the Third World Academy of Science contends: "It is critical that the potential benefits of [transgenic] technology become available to developing countries." It is also critical that industrialized countries not stand in their way. ❑

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❑ RICE: WHY IT'S SO ESSENTIAL FOR GLOBAL SECURITY AND STABILITY

By Ronald Cantrell, Director General, International Rice Research Institute

There is not enough land, water, or money to produce all the rice the world's growing population needs, says Ronald Cantrell, director general of the International Rice Research Institute in the Philippines. The challenge for the plant research community, he adds, is to develop efficient and freely available ways to tap into the rice genome sequence to produce higher yielding, more nutritious, and more resistant rice.

What's so special about rice production? Put simply, no other economic activity feeds so many people, supports so many families, is so crucial to the development of so many nations, and has more impact on so much of our environment. Rice production feeds almost half the planet each day, provides most of the main income for millions of poor rural households, can topple governments, and covers 11 percent of the earth's arable area.

But there is something else about rice that many may see as even more impressive and important. That is the enormous success we have had in using rice to improve the lives of world's poor and deprived. By providing rice farmers with options and new technologies — and so helping them boost production — extraordinary things have been achieved. In much of Asia, plentiful, cheap rice has been the propelling force behind the region's economic, political, and social stability. Rice has kept the continent nourished, employed, and peaceful.

THE ASIAN MIRACLE

The true Asian miracle hasn't been stunning economic development; it's been keeping people fed and societies stable.

This vast continent grows — and eats — more than 90 percent of all the world's rice on more than 250 million tiny farms, with most Asians eating rice two or three times a day. Half of every harvest never even leaves the farm: it feeds the family that planted it. Hundreds of millions of poor people spend half to three-fourths of their incomes on rice — and nothing else. For these people, rice anchors their precarious lives.

Farmers have grown an astounding 2.5 percent more rice each year since 1965. This "extra rice" feeds an additional 600 million people and has helped us stay neck and neck with the ever-growing demand. Increasingly bountiful rice harvests from the late 1970s through the late 1980s — mainly thanks to high-yielding modern varieties, more irrigation, and more access to credit — have accounted for nearly four-fifths of this growth. The result? A stunning drop in the real price of rice.

This cheap rice is the single most important contribution rice research and new farming technologies have made in Asia. American researchers have found that the development of improved rice varieties between 1970 and 1995 had a substantial impact in four major areas. Their findings indicate that were it not for the development of improved rice varieties:

- Rice prices for consumers could have been up to 41 percent higher.
- Rice-producing nations would be importing up to 8 percent more food.
- Millions of hectares of forests and other fragile ecosystems would have been lost.
- Between 1.5 and 2 percent more children would have been malnourished in developing countries.

Such achievements are truly impressive, and it should be reassuring to many that rice research — and the way it provides options and new technologies to farmers and consumers — can supply proven solutions to solve the world's environmental, food safety, and security problems.

It's also crucial to note that in achieving these successes, we have helped build capacity and provided training in many of the world's poorest nations. To give just one example, in Cambodia the dreaded Khmer Rouge left only one agricultural scientist alive, slaughtering all other

scientists involved in rural work. But as of 2001, not only did that previously impoverished nation achieve basic food security, it also opened the Cambodian Agricultural Research and Development Institute — an essential bulwark against future famine and deprivation.

FOUR MAJOR CHALLENGES

While we may have a gotten a few things right so far, millions of the world's rice farmers and consumers still live in poverty and destitution. What's urgently needed now is a renewed effort and commitment, where we use the lessons of the past to solve the looming crisis of the future. Four of the biggest problems facing us with rice production — arguably the most important economic activity on the planet — can be summed up quite simply: not enough land, labor, water, or cash.

Not enough land because so many of the world's best rice farms are being converted for other activities, such as to accommodate more profitable agriculture, to enable factory construction, or to handle spreading urban sprawl. In turn this has pushed rice farmers into more fragile lands, which in many cases include our last remaining areas of rainforest or other precious environments.

Not enough labor because rice farming is hard, unrewarding work. Most of the world's millions of rice farms are too small to justify or pay for mechanization. And increasingly in the many countries that have achieved food security, factory work is far more attractive than breaking your back ploughing a field in the midday sun.

Not enough water because with traditional, irrigated rice farming, it could take up to 5,000 liters of water to produce just one kilogram of rice. Already research has helped to considerably reduce this amount, but many rice farmers are increasingly being told they must cut back even more as they watch their water supplies be sucked away, usually to ever-expanding cities.

While each of these problems presents huge challenges that will take the very best science has to offer to find solutions, it is the fourth problem — poverty — that is perhaps the most daunting of all. In many ways the rice-producing nations of the world have solved their first and most important problem — they have ensured that their citizens have enough to eat.

But we all should partly share the blame for our failure to achieve a second, equally important goal — that is, to lift the world's rice farmers and consumers out of the poverty and squalor in which they have been trapped for so long. While this is the bad news, the goods news is that exciting new strategies and tools are emerging to help us deal with poverty — perhaps the most intractable development problem of all.

THE BURGEONING HYBRID RICE INDUSTRY

To many outsiders one of the most striking aspects of rice production is the fact that such a huge and important industry has so little real private sector activity. Only 6 percent of the world's rice crop is traded internationally, and only in recent years have a small number of big companies involved in agriculture started to invest more in rice. Crop protection firms have been active for many years, but this is the only sector of the rice industry with any major private sector presence.

Therefore, one of the most exciting developments in rice production from the private sector's point of view has been the ongoing spread and development of a hybrid rice industry. Hybrid rice cultivars can out-yield modern, semi-dwarf inbred varieties by more than 20 percent; last year they covered about 15.5 million hectares — or half of China's rice area — contributing 57 percent of the country's total rice production. The average hybrid yield is 6.9 tons per hectare, against 5.4 tons per hectare for inbred varieties. From 1976 to 2000 in China, the cumulative cultivated area under hybrid rice totaled 271 million hectares, with the total increase in grain production output at 400 million tons.

In Vietnam, more than 480,000 hectares of hybrid rice is cultivated, while 200,000 hectares were planted in India in 2001. The Philippine government has been one of the most committed to hybrid rice technology, in the hope that it will help to finally provide the nation with its long-cherished goal of rice self-sufficiency.

THE BIOTECHNOLOGY DEBATE

But while hybrid rice may have gotten some of the private sector interested in rice for the first time, it is, of course, biotechnology and its potential impact on so many aspects of rice production that generates the most excitement and controversy. The challenge for all those involved in the biotechnology debate in relation to rice is to ensure that the interests of rice farmers — most of

whom remain illiterate and uneducated — are fairly and properly represented, while ensuring that they are not deprived of exciting new options they themselves want and need.

While it is essential that traditional varieties and traditional farming practices — for example — be carefully protected and preserved, this should not be at the expense of new technologies and options. Many have expressed concern that modern high-yielding rice varieties now dominate rice production at the expense of traditional varieties, thereby reducing the planet's biodiversity. But when researchers successfully use the latest tools of science to produce an exciting new rice variety resistant to a troublesome disease or pest, farmers should have the option to use it, not be made to think they should use only their traditional varieties for the sake of biodiversity.

More exciting, new options — such as pest-resistant varieties, rice crops that can grow in salty water, and plants better able to resist drought — will be developed by the private sector, and it is vital that these new opportunities reach those who need them most. At the same time, the interests of rice farmers and consumers must be protected and, more importantly, be better understood.

Clearly there is a role for private sector research in relation to rice and biotechnology, but this cannot and should not be at the expense of farmers and consumers, especially in relation to their health and the environment. However, two well-known examples — "Golden Rice," or rice enriched with vitamin A, and the decoding of the rice genome by different groups — amply demonstrate the great potential of biotechnology and, at the same time, bog it in controversy.

While societies in Europe, North America, and Japan have the freedom to debate the pros and cons of their development and consumption of genetically modified organisms, it would be wrong for such debate to impede basic research to study whether such technologies are safe, sustainable, and suitable for the rice-producing nations of the developing world. Such countries must be allowed the right to make their own decisions on biotechnology, which they cannot do if access to such technology is denied to them.

An excellent example of the perils of the biotechnology debate is vitamin A rice. The International Rice Research Institute (IRRI) considers rice enriched with vitamin A through genetic modification to be an exciting new option provided by biotechnology. However, many months of research are still required to establish whether this so-called Golden Rice will ever make it into the bowls of rice consumers.

Even before we get to questions on food safety, we must find out if rice enriched with vitamin A will yield well, if it will be resistant to pests and diseases, and if it will affect other functions of the rice plant. Then there are still more important questions to be answered in relation to food safety, consumer acceptability, and biodigestibility.

However, such is the media hype over Golden Rice that the debate is increasingly focused on whether it should be allowed on consumer tables, when we still have not answered far more basic production and development questions. Unless common sense prevails, vitamin A rice may be an idea proposed and rejected, even before we know if it is possible.

DECODING THE RICE GENOME

As for the decoding of the rice genome, clearly it signals a new era not only in the sharing of knowledge for the benefit of mankind by the private sector but also in the use of science to help the poor. However, it is important to stress that despite the great significance of the sequencing work announced by two groups on April 5 of this year, a complete understanding of the rice genome has still not been reached.

The information we have now will be combined with a complete rice genome sequence being compiled by the public International Rice Genome Sequencing Project (IRGSP) coordinated by the Japan Rice Genome Program. This finely detailed IRGSP sequence — which will have an error rate of less than 0.01 percent — is expected to be published by the end of this year and will become the gold standard for all future investigations of genetic variation in all crops, not just rice. Knowing the sequence of specific genes will allow us to tap into the natural genetic variation of almost any crop species.

Although achieving food security in any country requires a multitude of social and economic solutions, the new knowledge derived from genomics research will make a vitally important contribution. The challenge ahead for the plant research community is to design efficient, freely

available ways to tap into the wealth of rice genome sequence information we now have to address production constraints in an environmentally sustainable manner.

Perhaps like no other crop, therefore, rice needs a strong, well-resourced public research effort. Public institutions like the IRRI are firmly focused on maintaining their roles as "honest brokers" — ensuring that rice farmers and consumers get the best deal and the best options offered by science and the private sector, while helping companies find ways to get the returns they need to support the further development of their activities and the rice industry.

To give just one, crucially important, example, the next step after the decoding of the rice genome will be to start to identify gene functions in rice. Which gene gives rice its color? Its flavor? Makes it grow well in water? Or makes it grow well when it doesn't rain? Once these functions have been identified they can be patented.

ADDRESSING REMAINING PROBLEMS

IRRI's role here as a broker is clear. Even though such gene function research will require a major investment, this should not prevent poor farmers from having access to any important breakthroughs. It is understandable that, if left to the private sector, the focus will be on gaining a return on such research. But, clearly, the first priority should not be profit, but what will best help the millions of poor rice farmers of the world prosper and develop.

As we continue to grapple with the problems of not enough land, labor, water, and income for the world's most important economic activity, it's clear that, ultimately, we will have the knowledge, skills, and tools we need to solve them. Perhaps the real challenge will not be in finding the answers, but in ensuring that the technologies and opportunities that in many cases are already taken for granted in developed world agriculture can finally reach the rice farmers of the developing world. Doing this will require resources, commitment, and vision. The Green Revolution showed that rice research can help solve even our biggest and most difficult problems. What we need now are the same resources, commitment, and vision to finally solve the big problems that remain. ❑

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TWO VIEWS ON FOOD LABELING

Few food issues have elicited as much controversy as has labeling. While all agree that consumers around the world should have accurate information about the nutritional content of their food, the exact nature of what food labels should include is at the heart of international negotiations within the Codex Alimentarius Commission — a joint body of the Food and Agriculture Organization and World Health Organization charged with reaching common agreement on key food safety issues.

Two opposing views follow to provide a full picture of the shape of the discussion in the United States. Ellen Matten, international policy analyst in the U.S. Office of Codex, argues that labels that show the country of origin of individual ingredients of food would be burdensome — particularly for developing country exporters — and provide no additional safety benefits to consumers. She also suggests that labels on genetically engineered foods, where there is no evidence that the composition, nutritional value, or intended use of the food has been altered, have the potential to be perceived by many consumers as a warning that the product is unsafe. Kristin Dawkins and Neil Sorensen of the Institute for Agriculture and Trade Policy say that the lack of information on the long-term health effects of genetically engineered foods argues for mandatory labeling.

FOOD LABELING IN CODEX ALIMENTARUS

By Ellen Matten, International Policy Analyst, U.S. Codex Office

International trade in food increased dramatically in the 20th century. At the same time, countries independently adopted different sets of food laws and standards, giving rise to trade barriers that have been of increasing concern to food traders.

The Codex Alimentarius Commission (Codex) was created in 1962 by two United Nations organizations — the Food and Agriculture Organization (FAO) and the World Health Organization (WHO) — as a result of these concerns. Organizers felt that if all countries harmonized their food laws and adopted internationally agreed standards, such issues would be dealt with naturally. Through harmonization, they envisaged fewer barriers to trade and a freer movement of food products among countries, which would benefit farmers and their families and help reduce hunger and poverty. Codex has become the major international mechanism for encouraging fair international trade in food while promoting the health and economic interests of consumers.

Codex has special relevance to the ever-expanding global food market. The advantages of having universally uniform food standards to protect consumers are evident.

(continued on next page)

LABELING AND TRACEABILITY OF BIOENGINEERED FOODS

By Kristin Dawkins, Vice President, and Neil Sorensen, Program Associate, Institute for Agriculture and Trade Policy

The United States has long been the world's preeminent leader in the development of food safety laws and regulations. In 1902 the U.S. Congress appropriated money to study the effects of chemical preservatives and colors on digestion and health. Public support for federal food and drug laws has been growing ever since.

In 1906 President Theodore Roosevelt signed the Wiley Act, making it illegal to distribute any mislabeled or adulterated foods or drugs. In 1943, in *U.S. v. Dotterweich,* the U.S. Supreme Court ruled that the responsible officials of a corporation and the corporation itself may be prosecuted for violations of food and drug laws. The 1954 Federal Food, Drug, and Cosmetic Act established the Delaney Clause, which banned pesticide residues or food additives that had been found to be carcinogenic in animals. President John F. Kennedy in 1962 called on Congress to develop a Consumer Bill of Rights that included the right to safety, the right to choose, the right to be heard, and the right to be informed. In 1966 the United States passed the Fair Packaging and Labeling Act, requiring that all consumer products in interstate commerce be honestly and informatively labeled. With respect to conventional

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The Agreement on the Application of Sanitary and Phytosanitary Measures (SPS) and the Agreement on Technical Barriers to Trade (TBT) both encourage the international harmonization of food standards. A product of the Uruguay Round of multinational trade negotiations, the SPS agreement cites Codex standards, guidelines, and recommendations as the preferred international measures for facilitating international trade in food. Codex standards have become the benchmarks against which national food measures and regulations are evaluated within the legal parameters of the Uruguay Round Agreements.

The Codex Alimentarius Commission established the Codex Committee on Food Labeling in 1965. The commission recognized that food labeling is the primary means of communication between the producer and seller of food on one hand, and the purchaser and consumer on the other. The committee tackles tough issues where multiple labeling regimes may cause barriers to trade. Issues currently before the committee include country of origin labeling, labeling of foods derived from modern biotechnology, and misleading food labels.

COUNTRY OF ORIGIN LABELING

Many countries have a "country of origin" labeling requirement for food products sold in their country. In the existing Codex General Standard for the Labeling of Prepackaged Foods, there is a requirement for country of origin labeling where its omission would mislead or deceive the consumer. Most countries, including the United States, already have in place regulatory requirements for country of origin labeling of food.

Discussions are currently taking place in the Codex Committee on Food Labeling (CCFL) about whether to expand current requirements and mandate that country of origin labeling include labeling ingredients of composite foods. Some countries feel this would be burdensome, impractical, and provide no additional benefit to the consumer. And there is no evidence to warrant these changes because of food safety concerns.

Expanding country of origin labeling requirements beyond the origin of the food to the food's ingredients is particularly troublesome to some countries, including the United States. Ingredients may be sourced from suppliers in different countries during different times of the year or from multiple countries and then commingled. Variations in ingredient availability as well as quality affect usage and manufacturing decisions by food companies. Ingredient manufacturers, brokers, and food processors and manufacturers would be required to segregate ingredients from different countries in order to ensure proper compliance with ingredient origin labeling requirements and to maintain a myriad of labels to correspond to every possible mix or combination of sources of ingredients. This would be particularly burdensome for less developed countries.

Because of this, work on international harmonization of rules of origin has been under way for several years in the World Trade Organization (WTO), with technical assistance from the World Customs Organization, as part of the WTO Agreement on Rules of Origin concluded in 1994.

Existing international trade rules under the WTO Agreement on Technical Barriers to Trade prohibit technical regulations — including labeling requirements — from creating unnecessary obstacles to international trade. Regulations may not be more restrictive than necessary to fulfill certain identified legitimate objectives. Expanded mandatory country of origin labeling requirements would most likely create an unnecessary obstacle to trade with no legitimate or internationally recognized justification.

LABELING OF FOOD DERIVED FROM MODERN BIOTECHNOLOGY

Perhaps the most complex and controversial labeling issue in the international arena is the labeling of foods derived through modern biotechnology. Within the Codex Committee on Food Labeling there appears to be consensus that labeling is needed for foods derived from modern technology when there are significant changes in composition, nutritional value, or intended use and it is important to provide such information to consumers. The CCFL has achieved a consensus on the labeling of allergens in foods derived from modern biotechnology and believes that such provisions provide considerable assistance to and protection for consumers. However, there is no consensus among Codex countries about a mandatory process-based labeling of foods derived from modern biotechnology.

Some countries believe that a mandatory process-based label on genetically engineered food may be perceived by many consumers as a warning label that the product is unsafe, and therefore could be misleading and

inappropriate as a mandatory international guideline. Foods derived from biotechnology are not inherently less safe than other foods.

These same countries are concerned that the text of draft guidelines the committee is developing fails to address the practical implications that must be considered by countries before mandatory process-based labeling is implemented. More specifically, the text fails to address many technical matters that are as yet unresolved and are potentially problematic in the implementation of such labeling. The United States believes that the CCFL should more carefully and more thoroughly explore and consider the numerous and potentially problematic implications of any process-based labeling before recommending such an approach for an international standard.

MISLEADING FOOD LABELS

Consumers around the world increasingly have access to new food products and information about food. While this is generally positive, it has raised concerns that consumers could be mislead by food labels. This topic is very important to Codex because of the potential for misleading food labels to adversely affect both consumer health and food trade. Truthful but misleading communications may lead consumers to make incorrect inferences. Both the presence and absence of information are relevant to whether labeling is misleading.

The influence of culture is particularly important in understanding why consumers in different countries interpret identical communications differently. Culture can be defined as the values, preferences, and acceptable rules of behavior of a group — such as people within a country or region — that are handed down from one generation to the next. Cultural differences influence the type of inferences, if any, that consumers make when they process a label statement, symbol, or image. Therefore, a communication may result in misleading inferences in one culture but not in another. For example, consumers in one culture might perceive terms such as "premium" and "best" to imply superior quality, while consumers in another culture might disregard such terms because they view such statements as typical promotional exaggerations.

Misleading communications often involve statements, symbols, or images that are literally true but lead consumers to make false inferences. The interpretation of misleading claims may be affected by factors such as culture, knowledge and education, and label characteristics. A label that is misleading to one group or culture may not be misleading to another. Labels can be misleading because a material fact has been omitted, confusing language or symbols are used, consumers make incorrect inferences to an attribute that is the subject of a claim, consumers make incorrect inferences to unmentioned attributes, or an endorser is improperly used. Misleading representations on the food label can be prevented, for example, by requiring additional information, by establishing standards, or by prohibiting representations that are judged inherently misleading.

In the future, Codex and the CCFL will continue to elaborate recommendations, guidelines, and standards in the area of food labeling in response to their mandate to improve communications between food producers and sellers, and purchasers and consumers. Perhaps then some barriers to trade will be removed and a freer movement of foods among countries will take place, which will be of benefit to farmers and their families and help reduce hunger and poverty. ❑

(Dawkins/Sorensen, from page 26)

foods, the Food and Drug Administration has effectively implemented this law.

The significance of U.S. leadership in food safety issues should not be underestimated, nor should the role of the United States as the world's leader and innovator in sound policies toward biosafety and consumer protection be diminished. Now more than ever, the United States should follow the path it inaugurated long ago and institute the most comprehensive and stringent regulations possible to protect the health and safety of every American, and ultimately of everyone in the world.

ENSURING ADEQUATE PROTECTIONS

With advances in agricultural biotechnology, it would behoove the United States to enhance existing food regulations and launch across-the-board pre-market safety testing, labeling, and traceability requirements for all food products and animal feed. We are at the threshold of a new era in which scientists have broken the boundaries of life forms and can extract, add, and manipulate genetic information in infinitely conceivable ways. With these abilities comes an even greater responsibility to ensure that adequate protections for the food supply are maintained and to limit the possibility of any negative consequences that may result from the introduction of foreign genetic material. If we choose not to track the inputs and constitution of food and feed, we will not be able to correct potentially dangerous outcomes or determine sources of contamination, let alone comply with the Fair Packaging and Labeling Act.

The Codex Alimentarius Commission is the body responsible for compiling the standards, codes of practice, guidelines, and recommendations that constitute the "food code" — or Codex Alimentarius — for the World Health Organization (WHO) and the Food and Agriculture Organization (FAO) of the United Nations. The commission recommends that the "presence in any food or food ingredients obtained through biotechnology of an allergen" from soybeans, milk and milk products, and many other foods known to be allergenic be labeled as such. The commission also recommends that genetically modified foods be subject to risk management considerations in accordance with the draft *Codex Principles for the Risk Analysis of Foods Derived from Modern Biotechnology* before consideration for commercial distribution.

The standards for safety assessment are characterized by a comparison between bioengineered whole foods or their components relative to the traditionally cultivated varieties. The standards attempt to take into account both intended and unintended effects to identify new or altered hazards and changes in key nutrients. Risk management practices should, the draft standards say, at a minimum include the verification of conclusions about the absence or the possible occurrence, impact, and significance of potential consumer health effects, and should monitor changes in nutrient intake levels to determine their human health impact.

Further, the *Codex Draft Guidelines for the Conduct of Food Safety Assessment of Foods Derived From Recombinant DNA Plants* states that "animal studies cannot readily be applied to testing the risks associated with whole foods, which are complex mixtures of compounds, often characterized by a wide variation in composition and nutritional value." The guidelines continue to say that "detecting any potential adverse effects and relating these conclusively to an individual characteristic of the food can therefore be extremely difficult."

THE FDA AND SUBSTANTIAL EQUIVALENCE

In stark contrast to the draft Codex guidelines, the U.S. Food and Drug Administration (FDA) performs safety testing only on animals, particularly mice. The resulting information is used to justify the doctrine of substantial equivalence, which, according to a 1992 *Federal Register* notice, means that the FDA regulates bioengineered foods by applying rules identical to those governing plants developed by traditional plant breeding. A joint FAO/WHO report by the Expert Consultation on Foods Derived from Biotechnology in June 2000 defined substantial equivalence much differently. The report's authors concluded that the notion of substantial equivalence is only a starting point, and that "further safety assessment will be focused on establishing the safety of the differences in the new product such that the safety of the food can be established."

In 2001 the European Union (EU) abandoned the doctrine of substantial equivalence, opting for more stringent scientific risk assessment. Actions to be carried out by the new European Food Authority now cover environmental risk and human and animal health and safety, and its opinions will be shared with the public for comment. The EU then has a democratic procedure by which a majority of member states within the European

Food Safety Authority Regulatory Committee vote to authorize or refuse a product.

The FDA's Voluntary Labeling Guidelines indicate that more than 50,000 comments about its policy regarding the safety and labeling of bioengineered foods have been received, and the vast majority of the comments are in favor of mandatory disclosure of genetically modified foods. The guidelines dismissed concern about the possible long-term consequences of bioengineered foods on health and the environment, concluding that "the comments were mainly expressions of concern about the unknown." That being said, the FDA's strategy for safety assessment and risk management has not attempted to substantiate the material facts of bioengineered foods and food safety. Furthermore, the FDA claims that "appropriately validated testing methods are not currently available for many foods," when, in fact, rapid quantitative tests are now common and inexpensive.

Many major U.S. trading partners have instituted labeling regimes for genetically modified foods and feed. Most notably, the European Union and China will require labeling and stringent traceability requirements, threatening the livelihoods of U.S. farmers and businesses who have already suffered as a result of the lack of regulatory oversight of biotechnology.

PRESCRIPTION FOR THE UNITED STATES

In sum, the United States should adopt a comprehensive pre-market safety testing, labeling, and traceability regime for bioengineered foods and feed to protect the health and safety of its citizenry and the environment and to ensure continued trade with our major economic partners. The United States has the responsibility to continue its leadership role in the development of sound policies for food safety around the world. In the case of genetically modified foods, the United States is quickly falling behind.

The doctrine of substantial equivalence should be abandoned, and the safety assessment and risk management strategies contained in the draft principles and guidelines of the Codex Alimentarius Commission should be formally adopted by the U.S. government and expanded upon. ❑

Note: The opinions expressed in this article do not necessarily reflect the views or policies of the U.S. Department of State.

❑ PROCESSING TECHNOLOGIES TO PROTECT FOOD

By Timothy Willard, Vice President of Communications, National Food Processors Association

Food processes that retard the deterioration of foods and prolong shelf life make an important contribution to world food security by providing consumers with foods whose safety and nutritional quality are unquestioned, says Timothy Willard, vice president of communications for the National Food Processors Association. Williard discusses such technologies as aseptic packaging, irradiation, ultra-high pressure processing, pulse light and ultraviolet light, as well as several food safety management systems.

Any discussion of the world's food supply — and of providing safe and nutritious food to consumers in all nations — should emphasize the importance of food safety, as well as the critical role of food processing technologies, in ensuring food security and safety for the world's chronic hungry.

A primary goal of food processing is to retard the deterioration of foods and prolong shelf life. Many processes — canning, for example — transform perishable foods into products that are stable, nutritious, and safe for years.

The food processing industry shares a common goal both with U.S. government food agencies and with international bodies such as the Codex Alimentarius of ensuring that consumers are provided with safe and nutritious foods and that the laws and regulations governing food and food safety are based on sound science. It is science — applied to the production, processing, packaging, and distribution of foods — that allows us to produce safe, wholesome, and nutritious products. A science-based approach to global food security should include the entire food chain, from farm to table, and effective consumer education on food safety.

Cooperative efforts between the food industry and national and international regulatory bodies are critical. It is in everyone's best interest that the status and credibility of these agencies are enhanced. We must educate consumers on the rigorous safety activities undertaken both by the food processing industry and by the regulatory agencies so that they have confidence in the safety of the food supply.

Too often food safety is not included in discussions of world food security. In industrialized nations, the adequacy and safety of the food supply often is taken for granted by consumers. In developing countries, however, having an adequate and safe food supply — particularly for children — is a critical issue.

Food processing in all its various forms brings immeasurable benefits in terms of availability, shelf-life, and safety. This is important for safely feeding nations in which spoilage and other forms of damage and deterioration pose serious problems. Moreover, since processed products of all types retain their nutrients for an extended time, they are often the best way to provide countries experiencing chronic food shortages with an adequate supply of nutritious products.

FOOD PROCESSING TECHNOLOGIES

New food processing technologies can help enhance world food security and food safety. New technologies already in use — and some now moving from the research stage to implementation — include the following:

• Aseptic (germ free) packaging, which greatly increases the safe shelf life of various foods without requiring refrigeration. The uses of aseptic packaging are expanding from beverages into semi-solid foods such as stews. These developments in aseptic packaging are the result of strong collaborative efforts between U.S. and European researchers.

• Food irradiation, not a new technology but one increasingly used by both industrialized and developing countries, can reduce post-harvest loss of agricultural products resulting from insect infestation or microbial spoilage. Irradiation is also an important food safety tool because it destroys food-borne pathogens such as salmonella and E coli. And it can extend the shelf-life of perishable fruits, vegetables, meats, and poultry. Irradiation is a safe and economical technology that has been approved in more than 40 countries around the world and endorsed by international bodies such as the World Health Organization (WHO).

• Ultra-high pressure processing, in which food is packed in a flexible pouch and exposed to high-pressure atmosphere — the equivalent of 100,000 times the pressure of air in the Earth's atmosphere. High pressure processing pasteurizes a product, making it safer and shelf-stable. A U.S.-Mexico joint research process developed a shelf-stable guacamole mix that is now commercially available in both countries.

• Pulse light, a process in which foods are exposed to high-intensity light — many times the intensity of sunlight — that "surface sanitizes" food products such as fruits, vegetables, and non-ground meats.

• Ultraviolet light (UVL), which is being used to pasteurize food products such as fruit juices. Juices exposed to UVL can be pasteurized without heat treatment (such as cold pasteurization), rendering the juices safer and, in certain cases, eliminating the need for preservatives.

• Hazard Analysis Critical Control Point (HACCP) systems, a cutting-edge food safety management technology, which identify the critical control points in food production and correct potential safety problems before they occur. HACCP embraces the use of basic sanitation and food preparation practices that allow for the manufacture of safe, wholesome food. For example, the proper handling of ingredients and thorough cleaning of equipment after foods have been processed helps food companies to control the use of any ingredients to which certain consumers may be allergic (such as nuts or milk) and to ensure that they are not inadvertently included, even in trace amounts, in food products in which their presence is not intended.

SELECTING APPROPRIATE TECHNOLOGIES

While the gains from these new technologies are impressive, it is important to point out that older technologies or approaches to food safety can pay strong benefits in advancing food safety and security in developing nations. The introduction of traditional processes such as canning can dramatically enhance food safety in countries where such technologies or practices previously have not been widely used. For example, most canned tuna sold commercially in the United States is processed and canned in Thailand, whose food industry and national economy have benefited mightily from the establishment of wide-scale commercial canning operations. In developing nations, the focus should be not on finding the newest technology to enhance food safety, but on adopting the most appropriate technology given the country's needs and resources.

Also, it can be difficult to establish and use more innovative food processing technologies in developing countries because of the need for clean water for the safe manufacture of foods, processes for ensuring the safety of raw ingredients used, and adequate education in food safety, for workers in food plants. These considerations involve larger societal challenges in developing countries — in the country's education system, for example, or in its water supply infrastructure.

Food safety research should be a collaborative process involving both developed and developing countries. We must involve various scientific organizations and varying perspectives in addressing food safety issues and in researching methods to enhance food safety and food security worldwide

Obviously, proper consumer education programs are part and parcel of new science-based processes. Consumers must understand the benefits of pesticides, biotechnology, and irradiation if we are to achieve the world's food security goals.

Food processing, and its attendant food safety benefits, is an exportable technology. As this technology is transferred and more countries around the world become involved in food processing, they will be able to provide safer, shelf-stable products for their citizens, thereby contributing much to their own food security. Such nations also may eventually be able to export processed food products themselves, thus not only enhancing their economic status and involvement in world trade but also contributing to overall world food security.

The U.S. food processing industry is fully prepared to help educate consumers and government officials around the world about current and new food processing technologies and to provide technical and operational assistance to countries willing to support the food security goals of the world.

Note: The opinions expressed in this article do not necessarily reflect the views or policies of the U.S. Department of State.

❑ AGRICULTURAL TRADE

World Trade in Agricultural Products, 2000 — $558 billion
Top 15 Agricultural Exporters and Importers, 2000

Exporters	Value $1,000,000	World share percent
United States	70.87	12.7
France	36.52	6.5
Canada	34.79	6.2
Netherlands	34.14	6.1
Germany	27.76	5.0
Belgium	19.86	3.6
Spain	16.88	3.0
United Kingdom	16.67	3.0
China	16.38	2.9
Australia	16.37	2.9
Italy	16.09	2.9
Brazil	15.47	2.8
Thailand	13.28	2.4
Argentina[a]	11.97	2.2
Denmark	10.94	2.0
Total Above 15	**357.98**	**64.2**

Importers	Value 1,000,000	World share percent
United States	66.69	11.0
Japan	62.19	10.3
Germany	41.54	6.9
United Kingdom	32.49	5.4
France	30.39	5.0
Italy	29.39	4.9
Netherlands	20.90	3.5
China	19.54	3.2
Belgium	18.52	3.1
Spain	16.98	2.8
Canada[b]	15.27	2.5
Korea, Republic of	12.99	2.1
Hong Kong, China	11.73	—
retained imports	6.52	1.1
Mexico[b]	11.06	1.8

Importers	Value 1,000,000	World share percent
Russia[c]	9.87	1.6
Total Above 15	**394.32**	**65.2**

[a] 1999 instead of 2000
[b] Imports values at f.o.b. (free on board) where the seller pays for having goods packaged for shipment from a certain f.o.b. point.
[c] Includes World Trade Organization (WTO) Secretariat estimates.

Source: *WTO Trade Statistics 2001.*

Agricultural Products Share In Trade, 2000
Share in Total Merchandise, Percent

	Exports	Imports
World	9.0	9.0
North America	10.0	5.9
Latin America	18.4	9.0
Western Europe	9.4	10.0
Central/Eastern Europe/ Baltics/ Former Soviet Union	8.9	10.7
Africa	12.9	15.1
Middle East	2.4	13.1
Asia	6.5	9.4

Source: *WTO Trade Statistics 2001.*

U.S. Agricultural Exports by Region
(millions of dollars)

	2001	2002 est.
Western Europe	6,779	7,000
European Union	6,267	6,600
Belgium-Luxembourg	626	—
France	352	—
Germany	906	—
Italy	508	—
Netherlands	1,397	—
United Kingdom	1,051	—
Portugal	138	—
Spain, incl. Canary Islands	591	—
Other Western Europe	512	400
Switzerland	422	—
Eastern Europe	191	200
Poland	83	—
Former Yugoslavia	34	—
Romania	24	—
Former Soviet Union	1,029	1,300
Russia	823	1,100
Asia	22,321	23,100
West Asia (Mideast)	2,194	2,100
Turkey	569	600
Iraq	8	—
Israel, incl. Gaza and West Bank	436	—
Saudi Arabia	470	500
South Asia	571	700
Bangladesh	105	—
India	294	—
Pakistan	97	—
China	1,884	2,300
Japan	8,953	9,000
Southeast Asia	2,923	2,900
Indonesia	879	900
Philippines	836	800
Other East Asia	5,796	6,100
Korea, Republic of	2,552	2,800
Hong Kong	1,253	1,300
Taiwan	1,985	2,000

(continued)

	2001	2002 est.
Africa	2,125	2,100
North Africa	1,467	1,500
Morocco	120	—
Algeria	211	—
Egypt	1,008	1,100
Sub-Sahara	659	600
Nigeria	233	—
South Africa	108	—
Latin America and Caribbean	11,572	11,600
Brazil	219	200
Caribbean Islands	1,399	1,300
Central America	1,185	1,100
Colombia	442	400
Mexico	7,289	7,600
Peru	182	—
Venezuela	416	400
Canada	8,011	8,500
Oceania	473	500
Total	**52,783**	**54,500**

Based on fiscal year beginning October 1 and ending September 30. Austria, Finland, and Sweden are included in the European Union.

Source: *Agricultural Outlook, U.S. Department of Agriculture, March 2002.*

Import Tariffs by Processed Food Sector, Percent

	Meats	Dairy products	Veg. oils and fats	Sugar	Other
Canada	28.0	214.8	8.6	4.9	14.1
United States	4.7	42.5	4.3	53.4	11.4
Mexico	48.5	37.5	19.2	4.1	17.9
Rest of Americas	14.9	20.4	13.9	17.0	15.7
Australia/ New Zealand	3.8	3.0	2.6	1.4	5.1
Japan	48.8	287.0	6.6	116.1	38.3
Rest of Asia	16.2	18.9	31.6	18.4	20.5
European Union	11.3	6.5	5.1	36.2	9.2

Source: *How Would Food Markets Be Affected By Liberalizing Trade in Processed Foods?* Working Paper, U.S. International Trade Commission, August 2001.

Import Tariffs by Farm Sector, Percent

	Rice	Wheat	Other Grains	Oil Seeds	Sugar Crops	Veg., Fruits, Nuts	Live-stock	Wool, Silk
Canada	0.0	62.8	8.9	0.0	0.0	1.9	17.7	2.3
United States	4.9	2.6	0.6	17.7	0.7	4.7	0.7	0.9
Mexico	15.0	67.0	38.4	3.1	23.0	17.9	10.2	8.2
Rest of Americas	19.6	5.8	11.2	6.7	11.1	13.0	7.7	10.8
Australia/ New Zealand	0.8	0.0	0.8	1.3	0.0	1.7	0.3	0.6
Japan	409.0	249.2	20.2	76.4	0.0	44.9	26.1	54.7
Rest of Asia	3.8	15.5	130.8	64.8	7.7	24.8	9.2	13.3
European Union	43.1	10.7	8.3	0.0	110.8	5.5	4.2	0.0

Source: *How Would Food Markets Be Affected By Liberalizing Trade in Processed Foods*? Working Paper, U.S. International Trade Commission, August 2001.

Amounts of Arable Land
by Country
(hectares per capita)

	1979-81	1997-99
Afghanistan	0.50	0.32
Albania	0.22	0.17
Algeria	0.37	0.26
Angola	0.41	0.24
Argentina	0.89	0.69
Armenia	--	0.13
Australia	2.97	2.69
Austria	0.20	0.17
Azerbaijan	--	0.21
Bangladesh	0.10	0.06
Belarus	--	0.61
Belgium, Luxembourg	0.08	0.08
Benin	0.43	0.29
Bolivia	0.35	0.24
Bosnia and Herzegovina	--	0.13
Botswana	0.44	0.22
Brazil	0.32	0.32
Bulgaria	0.43	0.52
Burkina Faso	0.39	0.32
Burundi	0.22	0.12
Cambodia	0.29	0.32
Cameroon	0.68	0.42
Canada	1.86	1.51
Central African Republic	0.81	0.54
Chad	0.70	0.48
Chile	0.34	0.13
China	0.10	0.10
Hong Kong, China	0.00	0.00
Colombia	0.13	0.05
Congo, Dem. Republic	0.25	0.14
Congo, Republic	0.08	0.06
Costa Rica	0.12	0.06
Côte d'Ivoire	0.24	0.19
Croatia	--	0.32
Cuba	0.27	0.33
Czech Republic	--	0.30
Denmark	0.52	0.44
Dominican Republic	0.19	0.13
Ecuador	0.20	0.13
Egypt	0.06	0.05
El Salvador	0.12	0.09
Eritrea	--	0.12
Estonia	--	0.80
Ethiopia	--	0.16
Finland	0.50	0.42

	1979-81	1997-99
France	0.32	0.31
Gabon	0.42	0.28
Gambia, The	0.26	0.16
Georgia	--	0.15
Germany	0.15	0.14
Ghana	0.18	0.20
Greece	0.30	0.26
Guatemala	0.19	0.13
Guinea	0.16	0.12
Guinea-Bissau	0.34	0.26
Haiti	0.10	0.07
Honduras	0.44	0.25
Hungary	0.47	0.48
India	0.24	0.17
Indonesia	0.12	0.09
Iran	0.36	0.27
Iraq	0.40	0.23
Ireland	0.33	0.29
Israel	0.08	0.06
Italy	0.17	0.15
Jamaica	0.06	0.07
Japan	0.04	0.04
Jordan	0.14	0.05
Kazakhstan	--	1.99
Kenya	0.23	0.14
Korea, Dem. Republic	0.09	0.08
Korea, Republic	0.05	0.04
Kuwait	0.00	0.00
Kyrgyz Republic	--	0.28
Lao, People's Dem. Rep.	0.24	0.17
Latvia	--	0.75
Lebanon	0.07	0.04
Lesotho	0.22	0.16
Liberia	0.07	0.06
Libya	0.58	0.37
Lithuania	--	0.79
Macedonia	--	0.29
Madagascar	0.28	0.18
Malawi	0.25	0.19
Malaysia	0.07	0.08
Mali	0.31	0.45
Mauritania	0.14	0.20
Mauritius	0.10	0.09
Mexico	0.34	0.26
Moldova	--	0.42
Mongolia	0.71	0.56
Morocco	0.39	0.32
Mozambique	0.24	0.18

	1979-81	1997-99
Myanmar	0.28	0.21
Namibia	0.66	0.49
Nepal	0.16	0.13
Netherlands	0.06	0.06
New Zealand	0.80	0.41
Nicaragua	0.39	0.51
Niger	0.62	0.49
Nigeria	0.39	0.23
Norway	0.20	0.20
Oman	0.01	0.01
Pakistan	0.24	0.16
Panama	0.22	0.18
Papua New Guinea	0.01	0.01
Paraguay	0.52	0.42
Peru	0.19	0.15
Philippines	0.11	0.08
Poland	0.41	0.36
Portugal	0.25	0.19
Puerto Rico	0.02	0.01
Romania	0.44	0.41
Russia	--	0.86
Rwanda	0.15	0.10
Saudi Arabia	0.20	0.18
Senegal	0.42	0.25
Sierra Leone	0.14	0.10
Singapore	0.00	0.00
Slovak Republic	--	0.27
Slovenia	--	0.09
Somalia	0.15	0.13
South Africa	0.45	0.36
Spain	0.42	0.35
Sri Lanka	0.06	0.05
Sudan	0.64	0.56
Swaziland	0.30	0.17
Sweden	0.36	0.31
Switzerland	0.06	0.06
Syria	0.60	0.31
Tajikistan	--	0.12
Tanzania	0.16	0.12
Thailand	0.35	0.25
Togo	0.77	0.52
Trinidad and Tobago	0.06	0.06
Tunisia	0.51	0.31
Turkey	0.57	0.40
Turkmenistan	--	0.33
Uganda	0.32	0.24
Ukraine	--	0.65
United Arab Emirates	0.01	0.03

	1979-81	1997-99
United Kingdom	0.12	0.10
United States	0.83	0.64
Uruguay	0.48	0.38
Uzbekistan	--	0.19
Venezuela	0.19	0.11
Vietnam	0.11	0.07
West Bank and Gaza	--	--
Yemen	0.16	0.09
Yugoslavia	0.73	--
Zambia	0.89	0.54
Zimbabwe	0.35	0.27
Low Income	0.22	0.18
Middle Income	0.18	0.22
Lower Middle Income	0.13	0.20
Upper Middle Income	0.34	0.29
High Income	0.46	0.40
East Asia, Pacific	0.12	0.10
Europe, Central Asia	0.16	0.59
Latin America, Caribbean	0.32	0.27
Middle East, North Africa	0.29	0.20
South Asia	0.23	0.16
Sub-Saharan Africa	0.32	0.24
Europe EMU	0.23	0.21

Source: *World Development Indicators, 2002*, The World Bank.

KEY CONTACTS AND INTERNET SITES

UNITED STATES GOVERNMENT

U.S. Agency for International Development
www.usaid.gov/hum_response/

U.S. Department of Agriculture (USDA)

Animal and Plant Health Inspection Service
aphis.usda.gov

Economic Research Service
www.ers.usda.gov

Economics and Statistics System
usda.mannlib.cornell.edu

Food and Nutrition Information Center
www.nal.usda.gov/fnic

Food Safety and Inspection Service
fsis.usda.gov/index.htm

Foreign Agricultural Service/Food Aid Programs
www.fas.usda.gov/food-aid.html

Grain Inspection, Packers and Stockyards Administration
usda.gov/gipsa/

National Agricultural Library
www.nal.usda.gov

U.S. Department of Health and Human Services
Food and Drug Administration
Center for Food Safety and Applied Nutrition
cfsan.fda.gov/list.html

www.FoodSafety.gov
www.foodsafety.gov

U.S. House of Representatives Committee on Agriculture
agriculture.house.gov

U.S. Senate Committee on Agriculture, Nutrition, and Forestry
agriculture.senate.gov

ACADEMIC AND RESEARCH ORGANIZATION

AgWeb.com
AgWeb.com is an online news service for farmers, ranchers, and growers.
www.agweb.com

American Farm Bureau Federation
The American Farm Bureau Federation is the largest farm organization in the United States with more than 5 million members in the U.S. states and Puerto Rico. Its mission is to undertake programs that will improve the financial well-being and quality of life for farmers and ranchers.
www.fb.com
225 Touhy Ave
Park Ridge IL 60068
Tel: (847) 685-8600
Fax: (847) 685-8896

Bread for the World
Bread for the World is a nonpartisan advocacy network on domestic and international hunger issues. Its partner organization, Bread for the World Institute, carries out research and education on the causes of and solutions for hunger.
www.bread.org
50 F St NW Suite 500
Washington DC 20001
Tel (202) 639-9400
Fax (202) 639-9401

Center for Agricultural Biotechnology
The Center for Agricultural Biotechnology (CAB) is one of five research centers of the University of Maryland Biotechnology Institute. CAB's mission within the field of agricultural biotechnology is basic and applied research, education and training, and economic development.
www.umbi.umd.edu/~cab/
5115 Plant Sciences Bldg
University of Maryland
College Park MD 20742-4450
Tel (301) 405-1581
Fax (301) 314-9075

Center for Food and Nutrition Policy
The mission of the center is to advance rational, science-based food and nutrition policy through research, outreach, public service, teaching, and communications. The center conducts seminars and conferences presented globally for corporate executives and senior public policy-makers on issues related to food and nutrition. It also conducts a graduate program that awards master's degrees in public policy.
www.ceresnet.org
Virginia Polytechnic Institute and State University
1101 King St
Alexandria VA 22314-2944
Tel (703) 535-8230
Fax (703) 535-8234

CropLife America
CropLife America promotes the environmentally sound use of crop protection products for the economical production of safe, high-quality, abundant food, fiber, and other crops.
www.croplifeamerica.org
1156 15 St NW Suite 400
Washington DC 20005
Tel (202) 296-1585
Fax (202) 463-0474

Food and Agricultural Policy Research Institute
The Food and Agricultural Policy Research Institute (FAPRI) provides economic analysis for policy-makers, opinion leaders, and stakeholders in U.S. agriculture. FAPRI programs are conducted cooperatively by Iowa State University's Center for Agricultural and Rural Development (CARD) and the University of Missouri-Columbia.
www.fapri.org
www.missouri.edu
Iowa State University
578 Heady Hall
Ames IA 50011-107
Tel (515) 294-1183
Fax (515) 294-6336
University of Missouri-Columbia
Columbia MO 65211
Tel (573) 882-2121

Freeman Center for International Economic Policy
The Freeman Center focuses on global economic issues, monetary issues, the international competitiveness of agriculture, economic integration of the Western Hemisphere, and economic reform.
www.hhh.umn.edu/centers/freeman/
Hubert H. Humphrey Institute of Public Affairs
University of Minnesota
301 19 Ave S
Minneapolis MN 55455
Tel (612) 626-0564
Fax (612) 624-9084

Harvard Center for Risk Analysis, Program on Food Safety and Analysis
A main goal of the program is to inform legislators, community leaders, corporate officials, and journalists about the importance of risk analysis in the promotion of a safe food supply.
www.hcra.harvard.edu/food.html
718 Huntington Ave
Boston MA 02115-5924
Tel (617) 432-4497/4345
Fax (617) 432-0190

National Food Processors Association
The National Food Processors Association (NFPA) represents the U.S. food processing industry on scientific and public policy issues involving food safety, nutrition, technical and regulatory matters and consumer affairs. NFPA members produce processed and packaged fruit, vegetable, and grain products, meat, poultry, and seafood products, snacks, drinks and juices, or provide supplies and services to food manufacturers.
www.nfpa-food.org
1350 I St NW Suite 300
Washington DC 20005
Tel (202) 639-5900
Fax (202) 639-5932

INTERNATIONAL ORGANIZATIONS

Cairns Group
The Cairns Group is a coalition of 18 agricultural exporting countries that account for one-third of the world's agricultural exports. Members are: Argentina, Australia, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Fiji, Guatemala, Indonesia, Malaysia, New Zealand, Paraguay, the Philippines, South Africa, Thailand, and Uruguay.
www.cairnsgroup.org

Codex Alimentarius Commission
The Codex Alimentaris system presents an opportunity for all countries to join the international community in formulating and harmonizing food standards and ensuring their global implementation. It also allows them a role in the development of codes governing hygienic processing practices and recommendations relating to compliance with those standards.
www.codexalimentarius.net/
U.S. Manager for Codex
U.S. Department of Agriculture
Food Safety and Inspection Service
Room 4861 South Bldg
1400 Independence Ave SW
Washington DC 20250
Tel (202) 205-7760
Fax (202) 720-3157

Consultative Group on International Agricultural Research (CGIAR)
The Consultative Group on International Agricultural Research (CGIAR) is an association of public and private members in more than 100 countries. CGIAR was created in 1971 to mobilize cutting-edge science to reduce hunger and poverty, improve human nutrition and health, and protect the environment. CGIAR's research agenda includes the entire range of problems affecting agricultural productivity and links these problems to broader concerns about poverty reduction, sustainable management of natural resources, protection of biodiversity, and rural development.
www.cgiar.org
CGIAR Secretariat
The World Bank
MSN G6-601
1818 H St NW
Washington DC 20433
Tel (202) 473-8951
Fax (202) 473-8110

Convention on Biological Diversity
One of the key agreements adopted at the 1992 Earth Summit in Rio de Janeiro was the Convention on Biological Diversity. This pact among the majority of the world's governments sets out commitments for maintaining the world's ecological underpinnings in an environment of economic development. The convention has three main goals: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits from the use of genetic resources.
www.biodiv.org
Secretariat of the Convention on Biological Diversity
393 Saint Jacques St Suite 300
Montreal Quebec Canada
H2Y 1N9
Tel (514) 288-2220
Fax (514) 288-6588

European Commission Directorate-General for Agriculture
www.europa.eu.int/comm/agriculture

Food and Agriculture Organization
The Food and Agriculture Organization of the United Nations, founded in 1945, has a mandate to raise levels of nutrition and standards of living, to improve agricultural productivity, and to better the condition of rural populations. FAO is one of the largest specialized agencies in the United Nations system and the lead agency for agriculture, forestry, fisheries, and rural development. An intergovernmental organization, FAO has 183 member countries plus one member organization, the European Community.
www.fao.org
Secretariat of the Joint FAO/WHO
Food Standards Programme
Food and Agriculture Organization
Viale delle Terme di Caracalla
00100 Rome Italy
Tel 39(06) 5705.1
Fax 39(06) 5705.4593

International Food Information Council Foundation (IFIC)
IFIC collects and disseminates scientific information on food safety, nutrition, and health and works with scientific experts and through partnerships to help translate research into understandable and useful information for opinion leaders and ultimately, consumers. IFIC focuses primarily on U.S. issues and participates in an informal network of independent food information organizations in Europe, Asia, Australia, Canada, Japan, and Latin America.
www.ific.org/food
1100 Connecticut Ave NW Suite 430
Washington DC 20036
Tel (202) 296-6540
Fax (202) 296-6547

International Plant Genetic Resources Institute (IPGRI)
IPGRI is an international research institute with a mandate to advance the conservation and use of genetic diversity for the well-being of present and future generations. It is a center of the Consultative Group on International Agricultural Research (CGIAR).
www.ipgri.org
Via dei Tre Denari 472/a
00057 MACCARESE (Fiumicino) Italy
Tel (39) 06 6118406
Fax (39) 06 61979661

International Rice Research Institute (IRRI)
IRRI is a nonprofit agricultural research and training center established to improve the well-being of farmers and consumers, particularly those with low incomes. It is dedicated to helping farmers in developing countries produce more food on limited land using less water, less labor, and fewer chemical inputs, without harming the environment.
www.irri.org
DAPO Box 7777
Metro Manila Philippines
Tel (63-2) 845-0563/845-0569
Fax (63-2) 845-0606

International Service for National Agricultural Research (ISNAR)
Founded in 1979 and headquartered in The Hague, the Netherlands, ISNAR assists developing countries improve the performance of their national agricultural research systems and organizations by promoting appropriate agricultural research policies, sustainable research institutions, and improved research management.
www.isnar.cgiar.org
PO Box 93375
2509 AJ The Hague
The Netherlands
Tel 31-70-3496100
Fax 31-70-3819677

Organization for Economic Cooperation and Development (OECD)
Agriculture, Food and Fisheries
OECD is an international organization that helps governments deal with the economic, social and governance challenges of a globalized economy. OECD ministers of agriculture support the long-term objective of substantial progressive reductions in support and protection, have adopted a set of shared goals for the agro-food sector, and recognize that OECD's analysis is an essential contribution to the understanding of agricultural policies and their international impacts.
www.oecd.org
www.oecdwash.org
2001 L St NW Suite 650
Washington DC 20036-4922
Tel (202) 785-6323
Fax (202) 785-0350

United Nations Conference on Trade and Development (UNCTAD)
Agricultural Market Access Database (AMAD)
AMAD results from a cooperative effort by Agriculture and AgriFood Canada; the European Commission, Agriculture Directorate-General; the Food and Agriculture Organization of the United Nations; the Organization for Economic Cooperation and Development; the World Bank; the United Nations Conference on Trade and Development; and the U.S. Department of Agriculture, Economic Research Service.
www.amad.org

United Nations Conference on Trade and Development (UNCTAD)
Standing Committee on Poverty Alleviation
At UNCTAD VIII, held in Cartagena, Columbia, in 1992, a Standing Committee on Poverty Alleviation was created to contribute to national and international efforts to prevent, alleviate, and reduce poverty, particularly where it is more acute, as well as to formulate related national and international policies.
www.unctad.org/en/subsites/povall/pamain.htm

World Aquaculture Society (WAS)
WAS was founded to improve communication and information exchange among aquaculture interest groups.
was.org/main/FrameMain.asp
Delaware State University
Department of Agriculture and Natural Resources
1200 N Dupont Highway
Dover Deleware 19901-2277
Tel (302) 857-6436
Fax (302) 857-6430

World Food Program (WFP)
Established in 1963, WFP is the United Nations' frontline agency in the fight against global hunger. In 2000, WFP fed 83 million people in 83 countries, including most of the world's refugees and internally displaced people.
www.wfp.org
Via C.G.Viola 68
Parco dei Medici
00148 Rome Italy
Tel 39-06-65131
Fax 39-06-6513 2840

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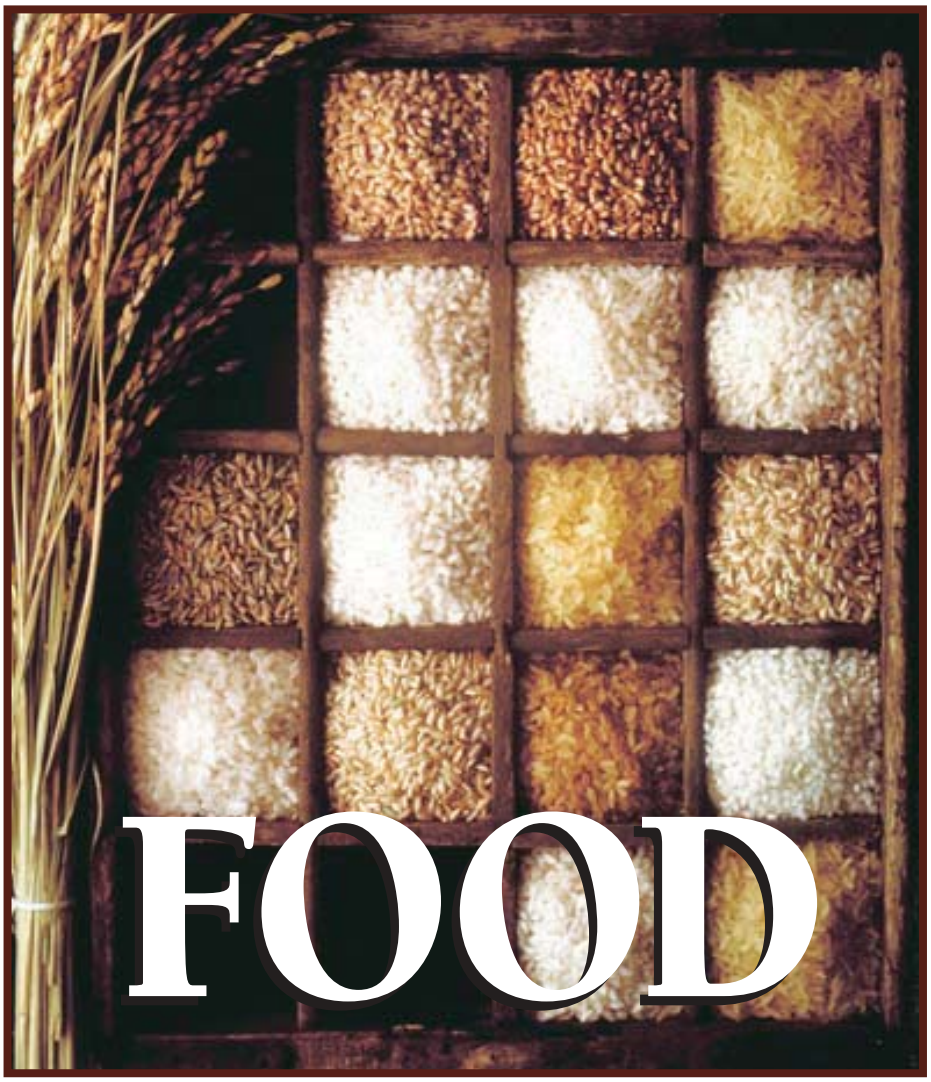

SECURITY AND SAFETY

May 2002