

# INTERNATIONAL AGRICULTURE

*Update*

UNIVERSITY OF ILLINOIS  
AT URBANA-CHAMPAIGN

COLLEGE OF AGRICULTURE

1987-Vol. 2, No. 1

## Training: An Investment for the Future

A corps of well-trained and motivated agriculturalists, working in effective institutions, is a crucial element for agricultural development in third world countries. Yet many developing countries lack the trained people needed to advance agriculture. Some of these countries are investing in training, both domestically and overseas, to develop their agricultural leadership. The College of Agriculture at the University of Illinois at Urbana-Champaign (UIUC) is assisting in this effort.

UIUC has a long and successful record in continuing education and human resource development in agriculture. As early as the 1870s, students from Japan and Greece were enrolled in the College of Agriculture. Today, one-third of the graduate students in the college are from other countries, the majority of this group representing developing countries that are seeking to improve their agriculture. Looking ahead, it appears that UIUC and other U.S. universities will continue to educate increasing numbers of students from the developing world.

Most development assistance agencies and donor organizations recognize that many third world countries lack both trained people and effective agricultural institutions. The response, particularly from the U.S. Agency for International Development (USAID), has been to emphasize "institution-building" projects. Human resource development and personnel training to staff the institutions being created or upgraded are an essential part of the institution-building process. It is, after all, people who shape the institutions and subsequently energize their nation's future.



Twenty-two faculty members from the NWFP AU, Peshawar, Pakistan, participated in a workshop on instructional skills held at SIUC in August 1986. The workshop supplemented their advanced-degree training at U.S. universities.

Donor and development assistance organizations depend heavily on their relationships with U.S. universities to implement institution-building projects. Universities are particularly effective in institutional development projects because large numbers of people usually must be trained as part of the plan to upgrade personnel. Educating people is what we do best. We are able to produce the scientists and administrators needed to establish and operate these emerging institutions.

**Project orientation.** The Office of International Agriculture (OIA) assists with the education and training of international students in support of UIUC's on-going agricultural development projects, programs, and contractual commitments. We often call it "participant

training" because these students are or will be actively participating in an institution-building project. The project supports their training, and it is the goals of the project that are considered when participants are chosen and training programs are designed.

Institution building and work with international students are not new to our faculty. The College of Agriculture has been involved in major institution-building projects in India, Jordan, Peru, Sierra Leone, and Sri Lanka. Our current projects are located in Zambia, Pakistan, and Kenya.

In support of the Zambia Agricultural Research and Extension (ZAMARE) project, for example, nearly 130 Zambians have received training. Degree training was arranged for 48 people, and the balance have attended specialized

technical short courses. Upon returning to Zambia, they will be better able to carry out their responsibilities as part of Zambia's agricultural research and extension system.

Our project in Pakistan, Transformation and Integration of the Provincial Agricultural Network (TIPAN), is developing an agricultural university that can serve farmers and all sectors of agriculture throughout the Northwest Frontier Province. Nearly 100 people will receive training outside of Pakistan during the first five years of the project. To date, 25 professors and research scientists have gone to the United States and selected other countries for postmasters or postdoctoral training programs. Another 33 Pakistanis are placed in advanced degree programs at UIUC and other U.S. universities.

The new Institutional Development for Agricultural Training (IDAT) project includes advanced degree training at UIUC and other universities for at least 50 faculty of Egerton University College at Njoro, Kenya. IDAT is an educational and scientific partnership that will help create an outstanding institution for agricultural education to serve Kenya and other African nations. IDAT will also provide a gateway for long-term institutional collaboration that will serve the agricultural faculty, students, and extension specialists of both universities and pay dividends to Illinois agriculture for many years to come.

**Short courses.** Consistent with this institution-building focus, programs such as the International Soybean Program (INTSOY) and the International Program for Agricultural Knowledge Systems (INTERPAKS) were established at UIUC to serve specific international clientele. As part of INTSOY's effort to establish and expand soybean industries in the developing world, 219 scientists from more than sixty countries have been trained through short courses on soybean processing and production held at UIUC. More than 200 others have attended region-specific

and country-specific workshops and training sessions held in Colombia, Ecuador, India, Nigeria, Pakistan, Peru, Sri Lanka, Turkey, and Zimbabwe.

INTERPAKS' mission is to strengthen agricultural and rural development programs by improving research and extension activities in both the private and public sectors. INTERPAKS is also concerned with strengthening the educational processes that train personnel for research and extension institutions. Short courses concentrate on the in-service educational needs of administrators — particularly those responsible for extension programs — and other professionals involved in agricultural knowledge systems. Courses are held annually at UIUC. INTERPAKS also organizes workshops for specific groups, which can be held at UIUC or anywhere in the world.

**Degree programs.** Another example of an OIA training activity is the administration of graduate degree programs for ministries of agriculture or other sponsoring organizations. A training project with the Ivory Coast Ministry of Agriculture, in operation from 1975 to 1985, produced 60 Ivorians with a masters degree in agriculture from more than twenty U.S. universities. A smaller project used OIA's management services to train scientists from Zaire to the masters-degree level.

**Training outside the United States.** We also give seminars, conferences, short courses, and workshops abroad that last from one to four weeks. Topics are selected on the basis of local or regional needs. INTSOY and INTERPAKS have sponsored programs in a score of countries and several languages.

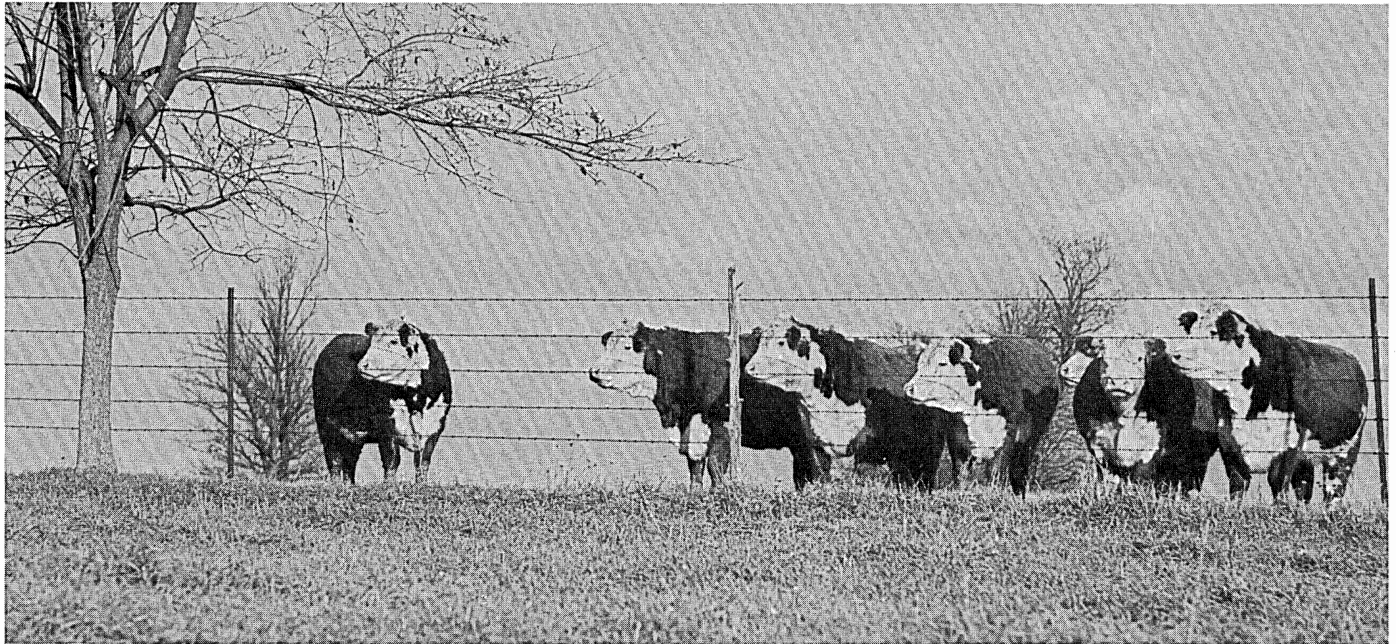
**Meeting the challenge.** In spite of the compelling rationale for training, some donor agencies have refrained from making heavy investments in human resource development. The management of training programs is complex and labor intensive, and sometimes many years pass before measurable

results are seen. The use of development resources for training is more difficult and demanding than shipping in tons of fertilizer. Similarly, some recipient countries would prefer to use the funds for showcase projects, such as dams, airports, and superhighways.

India is a country that invested heavily in training people and building institutions for agricultural education and research. There were deliberate government policies to get people overseas for training and to develop universities and research stations. In the 1950s and 1960s, the University of Illinois and several other U.S. universities were deeply involved in India's agricultural university development and educational programs. The success of this human resource development policy and these efforts to build institutions have been well documented.

**UIUC's role.** The Office of International Agriculture at UIUC is able to draw upon a wide range of educational resources to design training programs that capitalize on our experience and meet the unique needs of scientists, administrators, educators, and policy-makers from countries in various stages of development. Our objective in these projects is to establish the enthusiastic, committed, and well-trained staff that any young institution must have.

For more information about our training activities call or write Dr. John W. Santas, Assistant Director, Office of International Agriculture, 113 Mumford Hall, 1301 West Gregory Drive, Urbana, IL 61801, USA; telephone 217-333-3638. ■



Tick-borne diseases such as anaplasmosis and babesiosis pose a constant threat to the national and international livestock industries. Scientists at UIUC are now applying their successful research techniques on these diseases toward the development of a vaccine for human malaria, a disease that strikes 200 million people each year.

## Collaborative Research on the Control of Bovine and Human Blood Diseases

Miodrag Ristic and Sonia Montenegro-James

**T**he control of malaria, babesiosis, and anaplasmosis is one of the principal objectives of human and veterinary medicine. The diseases are equally important — malaria to human health, and anaplasmosis and babesiosis to the agricultural community. Over the last two decades, scientists in the Hemotropic Diseases Research Unit of the College of Veterinary Medicine, University of Illinois at Urbana-Champaign (UIUC), have been actively working to combat these diseases by developing safe and effective vaccines.

Malaria strikes nearly 200 million people worldwide each year, killing between 3 million and 5 million people annually. Although not a serious problem to people living in the United States, the World Health Organization and other international agencies consider malaria the number one infectious disease of humans.

Anaplasmosis and babesiosis are ranked among the most important diseases of cattle in the tropics and

subtropics and threaten most of the approximately 1.2 billion head of cattle in the world. They pose a constant threat to U.S. livestock. Even though babesiosis — once known as Texas cattle tick fever — has been eradicated in the United States, it occurs in Mexico and throughout Latin America, Africa, and South East Asia. Anaplasmosis occurs in Illinois and throughout the United States, but its greatest economic impact is in the southern and northwestern states. Anaplasmosis causes an average annual economic loss of \$100 million in the United States, and an estimated 50,000 to 100,000 animals die each year.

In Latin America and regions where anaplasmosis and babesiosis are endemic, they constitute one of the major constraints for the expected production and performance of cattle. They deprive subsistence farmers of food, draft power, and manure for crops, and limit the supply of export products for international markets.

Pressed by the need for economic improvements, some developing countries in tropical or semitropical regions are attempting to increase the productivity of commercial cattle operations by importing more productive breeds of cattle from countries with temperate climates. Imported cattle are highly susceptible to anaplasmosis and babesiosis and fare poorly when introduced into endemic areas. More severe in temperate than tropical breeds of cattle, the effects of these diseases include losses in meat and milk production, abortion, and temporary infertility. These losses and appreciable mortality may financially ruin farmers and livestock investors or at least cause them to lose confidence in imported breeds.

**Research on bovine diseases.** In the early stages of research in the 1960s, scientists in UIUC's Hemotropic Diseases Research Unit developed an attenuated (nonvirulent) vaccine against

*Anaplasma marginale*, the causative agent of bovine anaplasmosis. They also developed a blood test to diagnose anaplasmosis. These were submitted to rigorous testing under field conditions at the Veterinary Research Institute in Maracay, Venezuela. Since then, the vaccine and the blood test were used successfully under field conditions in Brazil, Colombia, Mexico, Peru, and Venezuela.

**Major research accomplishments.** A major breakthrough in the century-long struggle against bovine babesiosis occurred in the late 1970s when UIUC scientists devised a method to grow the causative agents of bovine babesiosis under artificial conditions in the laboratory. This achievement, which signified a new era in the study of bovine babesiosis, led to the development of a new vaccine and marked the first time that an organism-free vaccine was developed to protect animals from an infectious agent that invades red blood cells.

The new vaccine was first used successfully under field conditions in Mexico by the Mexican Center for Research on Animal Diseases. The application of these newly developed vaccines and testing procedures signified an important turning point in the efforts to conquer bovine anaplasmosis and babesiosis.

The Rockefeller Foundation was the principal sponsor of the babesiosis research from 1975 to 1982. Research was conducted at UIUC and in Mexico City in collaboration with the Mexican Center for Research on Animal Diseases.

Recently the Institute Merieux in Lyon, France, used this technology to develop a vaccine against canine babesiosis. Under the trade name "Pirodog," the vaccine is now being produced commercially.

**Current research.** During the last five years, a cooperative research program between scientists at UIUC and the Veterinary Research Institute in Maracay, Venezuela, has resulted in further accomplishments.

The programs in Venezuela involve testing the effectiveness of a

culture-derived soluble *Babesia* vaccine that was originally developed in UIUC's Hemotropic Diseases Research Unit. Numerous experimental vaccination trials have been conducted in the laboratory against different strains of the causative agents of bovine babesiosis and anaplasmosis.

Field trials are currently being conducted throughout Venezuela. Privately owned and government-owned sites were selected in areas where large-scale dairy and beef production are crucial for the livestock industry. These trials encompass a cattle population of more than 10,000 head.

The Veterinary Research Institute, under the auspices of the Venezuelan Ministry of Agriculture, is expected to produce and distribute a combined anaplasmosis-babesiosis vaccine next year. Livestock imported from the United States and Canada will be among the first to be vaccinated.

**International Laveran Foundation.** The successful development of an organism-free vaccine against babesiosis opened the door to new research against malaria. Malaria and babesiosis are similar, and their causative agents are biologically related. In both, the disease-causing organism invades red blood cells.

Two international conferences on malaria and babesiosis have been held, the first in Mexico City in 1979 and the second in Annecy, France, in 1983. Participants at the second conference unanimously recommended the formation of an international foundation to combat malaria and babesiosis. Established in 1984, the Laveran Foundation is named after Alphonso Laveran, the French military surgeon who first described the causative agent of human malaria.

Activities of the Laveran Foundation include sponsoring research and training, disseminating information on the prevention and control of malaria and babesiosis, and organizing conferences on the two diseases. The third international conference will be held in Annecy, France, in September 1987. The principal office of the Laveran

Foundation is in Annecy. Its office for the Americas is located in Urbana, Illinois, under the direction of Dr. Miodrag Ristic.

**Malaria vaccine research.** UIUC scientists are applying their successful research technology on babesiosis to malaria.

Two French institutions, the Grenoble Medical School and the Institute Merieux, are collaborating with UIUC scientists in the malaria research. Funding comes from the U.S. Agency for International Development. The U.S. government is interested in malaria research for several reasons. Many Americans travel to malarious zones each year and are highly vulnerable to the disease. Moreover, malaria poses a threat to American soldiers who are deployed in endemic areas.

Based on principles used to develop the vaccine against babesiosis, UIUC scientists are developing a vaccine that protects monkeys from severe malaria. They are analyzing the components that confer protection and plan to apply their findings to a vaccine for humans.

**For more information on the research program** write to Dr. Miodrag Ristic, 2812 Veterinary Medicine Basic Sciences Building, 2001 South Lincoln Avenue, Urbana, Illinois 61801, USA. Information on the Third International Conference on Malaria and Babesiosis is available from Dr. Ristic or the International Laveran Foundation, attn. Dr. L. Valette, "Les Pensières," 55 Route d'Annecy-Chavoires, 74290 Veyrier-du-Lac, France. □

*Miodrag Ristic directs the Hemotropic Diseases Research Unit and the research on malaria. Sonia Montenegro-James heads the research team at the Veterinary Research Institute, Maracay, Venezuela.*



U.S. agricultural policy has fostered one of the most efficient and stable systems in the world for producing food and fiber. Now some of these policies are reaching beyond our borders through shared knowledge and exported products.

## Agricultural Policy in International Relations

Robert G. F. Spitze

When the United States dramatically reduced its price support levels and increased export subsidization this year, consumers in Africa and farmers in Australia soon felt the shock. And when the Soviet Union failed to purchase its agreed-upon volume of wheat imports from this country, farmers and agribusinesses here in Illinois felt the impact. The world continues to shrink in terms of how far and how fast our nation's agricultural policies reach beyond our shores.

**An ever-changing world.** Agricultural policy clearly affects more than farming, and international relations go well beyond diplomatic summitry. The agricultural policies of nations today are intertwined with their international relations. Our own rural communities and the nations of the world have become mutually dependent, a fact that imposes itself in three major areas: at local policy meetings, during national policymaking, and in our research and educational programming.

Why have U.S. agricultural policy and international relations been drawn closer together? There are four compelling reasons.

First, agricultural trade has dramatically assumed a greater role in the U.S. economy. The value of U.S. agricultural exports jumped

from an average annual compound rate of 5.3 percent in the 1950s to 19 percent in the 1970s. By 1980, 30 percent of all U.S. agricultural commodities were exported, thus earning a substantial net trade surplus that helped reduce the rising nonfarm trade deficit. Yet this surge has turned around just as dramatically in the past few years and has already fallen by 40 percent.

Second, nations have become increasingly interdependent economically. World exports of all goods and services have grown even faster than U.S. agricultural exports.

Third, the risk of global devastation has risen. With contemporary weaponry, disagreements among nations could escalate to catastrophic violence.

Fourth, communication technology has mushroomed. As a consequence, the speed with which national policies impinge upon international relations has accelerated. Fortunately this very capability also permits swifter knowledge transfer so that the consequences of policies can be understood and conflicts negotiated more quickly than ever before.

**Evolution of agricultural policy.** Yet even while the world has been shrinking, agricultural policy has been expanding. Gradually the purpose of this policy evolved beyond farm production

into a broader agricultural policy. In recent decades, it has included issues of grain reserves, trade, public food programs, and even credit and research related to food security. Now that food has become an integral part of this policy, it is aptly known as agricultural and food policy.

This policy holds something in common with international relations. Both share a common origin in government. Not to be confused with the private decisions involved in farming and marketing, the word "policy" as used here refers to governmental decisions. In the United States, these arise from the participation of many individuals and interest groups, in contrast to many other countries where policies are shaped by authoritarian, single-interest governments.

Similarly, the term "international relations" here refers to decisions involving governments, some participatory and some dictatorial. Herein lies a potential for cooperation or for disaster. In the absence of a world government to reconcile country policies, the policymakers of separate national governments can shape agricultural and food policies that can either assist or disrupt relations among countries.

**Negative roles of policy.** Domestic policies increasingly affect international relations. For example, when the United States provides hefty subsidies for agricultural exports, we strain our relations with competing exporting nations. The consumers of importing countries may at first welcome such policies, but in the long run their own producers may suffer from such uneconomic competition.

By the same token, when the United States erects sturdy barriers to normal, competitive agricultural imports with no obvious reasons of food security, relations are strained because of potential losses for our consumers and for producers of the trading countries. Both types of policy thwart comparative economic advantages. But instead of focusing on the possible negative results of agricultural and food policies, let us identify some positive effects.

**Positive roles of policy.** For most of the two centuries of our agricultural and food policy, we have striven to improve the productive capacity of American agriculture. These efforts have ranged from the educational policy of the common schools provision of the Northwest Territory Ordinance (rural, section 16) to the Food Security Act of 1985. The flow of policy over the years fostered development of public research, education, family farm tenure, credit, land and water conservation, rural electrification, and price and income stability.

**Productive agriculture.** These basic institutions, in partnership with others such as private property, contract, and markets, provide one of the most efficient and stable systems in the world for the production of food and fiber. In fostering the system, U.S. policy has affected our international relations by increasing commercial agricultural exports and providing greater security for our own food supply. It has also affected these relations by giving dependable food aid — as mandated by Public Law 480 — to regions with chronic food shortages.

**Efficient marketing and distribution.** The partnership between U.S. public policy and private entrepreneurship has led to more efficient distribution. Because of this improved system of U.S. production and marketing, farmers and agribusinesses have gained markets for their products, and consumers worldwide have gained a dependable supply of low-cost food and fiber. Foreign exchange earnings have also helped balance the flow of trade.

Our economic development has rested on the growth of the U.S. agricultural sector. Without either a strong domestic agricultural base or a dependable trade source of food, economic development flounders. When policy fosters agricultural systems that are efficient, secure, and equitable, it contributes to positive international relations.

**Economic stability.** During the past half century, U.S. agricultural and food policy has tried to deal

with farm and food prices, farmer income, balancing production with demands, food assistance, and grain reserves. But these issues have been difficult, persistent, controversial, and often unresponsive to the cumbersome tools of public policy.

Yet, agricultural and food prices, incomes, and supplies in domestic and world markets were more stable in most years than they would probably have been without the policies. A greater degree of stability for both farmer and consumer was the result.

Economic growth thrives on two conditions: stability to encourage investments and uncertainty to permit change. However, extremes of either can thwart sound development. In providing stability when disruptive instability exists, policies contribute to orderly economic development around the world and to improved international relations.

**Knowledge and technology transfer.** For more than a century, U.S. agricultural and food policies have encouraged the development and dissemination of knowledge and technology. Being public, the results have been put to use not only in our own economy, but abroad as well. Some of our foreign assistance policies facilitated this transfer directly, while others fostered indigenous technology development abroad through institution building. Policies can thus improve international relations by contributing to the development of knowledge, its application in new technology, and its diffusion in the agricultural systems of the world.

**The process of public policy-making.** Many people participate in agricultural and food policymaking in the United States. Governmental actions therefore represent a composite — usually a compromise — of the diverse values and the wisdom of many individuals and interest groups. This policymaking process itself contributes to the growth and efficiency of our agricultural and food sector.

Transferring our understanding of the participatory nature of policymaking is an important kind of knowledge transfer. Policy has

unquestionably contributed to improved international relations by helping nations solve their economic problems in accord with the expressed desires and needs of most citizens, instead of only a few.

**Conciliation or conflict.** Individuals, interest groups, and nation states will inevitably have differences of opinion. If unresolved through peaceful means, these differences can lead to confrontation and eventual warfare. The effects on agriculture, economic development, and civilization can be devastating. Policies profoundly affect the delicate process of social problem solving. The process is particularly crucial for agricultural and food policy because of its importance in development, in rural life, and in trade — the most common way that nations relate to one another.

Policy can contribute to conciliation instead of conflict and to peace instead of war. Policy makes these worthy goals possible by improving the production and marketing of food and fiber; by enhancing economic stability, security, and equity; by developing and diffusing knowledge and technology; and by allowing citizens to be represented in the governmental policymaking process. ■

*Robert G. F. Spitze, professor of agricultural economics (excerpted from Illinois Research 27(1):16-18)*

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## Training Activities

### Training of Trainers for Agricultural and Rural Development

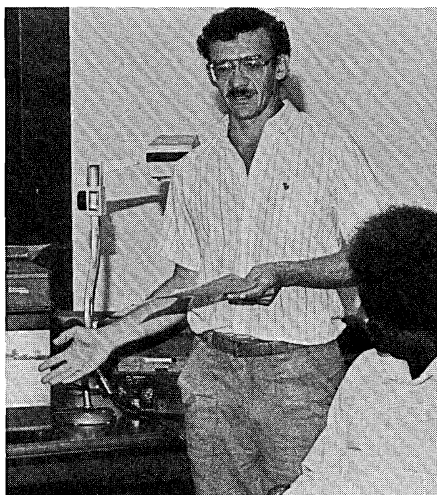
Dates: May 25 to June 20, 1987

Course coordinator: Violet M.

Malone, professor in the Office of Agricultural Communications and Extension Education and Illinois State Leader for Extension Education

This short course covers a range of subjects related to strengthening training programs, including needs assessment, curriculum development, teaching methods, instructional materials, evaluation, and management. Alternating theory and practice, the course capitalizes on the participant's past experience and future home needs. The course is designed to assist people involved in research, extension, or public service training programs and institutes; teachers of adult or extension education; and training advisors from international research centers and technical assistance organizations.

The course fee is US\$2,500. The suggested living allowance is US\$1,400.



In the INTERPAKS short course on training the trainers, participants alternate theory and practice to gain a broad understanding of the training process.

### Retrieval and Dissemination of Technical Agricultural Information

Dates: August 31 to September 18, 1987

Course Instructor: F. Wilfrid

Lancaster, professor in the Graduate School of Library and Information Science

This course addresses the need for increased exchange of technical agricultural information between international research centers, national research organizations, and extension systems. Programs in many developing countries do not yet take advantage of the advances in the storage, retrieval, and dissemination of technical information, nor of the use of microcomputers and other low-cost technology that allow researchers, students, and teachers worldwide to interact with scientific data bases. International and national research organizations need to strengthen their technical information systems in order to retrieve information and contribute to the world body of technical agricultural information.

The course is designed for professionals working in the information science field with national and international agricultural organizations. It reviews the information channels within the agricultural community, identifies the main information sources, covers how to organize modern information services to serve users, provides practical experience with microcomputer applications in library information centers and with building data bases, and familiarizes participants with professional literature and organizations in the subject area.

The course fee is US\$1,900. The suggested living allowance is US\$1,260.

### Organization and Management of Agricultural Extension Services: A New Look at Knowledge Transfer

Dates: September 6 to October 3, 1987

Course coordinator: John B. Claar, former Director of the Illinois Cooperative Extension Service

and Associate Vice-President for Public Service at UIUC

The ability of administrators to organize and carry out programs can make the difference between success and failure. Management of extension services is an especially difficult challenge for several reasons: many people must be supervised, offices and personnel are scattered over wide areas, a variety of duties are performed, several levels of management are involved, and relationships must be maintained with other branches of government and with nongovernment organizations.

Designed for extension administrators and teachers, this short course provides an in-depth examination of management concepts and techniques relating to the organization and operation of extension services. The major extension systems in use around the world are reviewed, and participants will conduct research on problems specific to their home environment.

The course fee is US\$2,550. The suggested living allowance is US\$1,780.

### Soybean Processing for Food Uses

Dates: November 1987 or January 1988

Course coordinator: Wilmot B.

Wijeratne, Research Associate, INTSOY

Soybean Processing for Food Uses is a course designed to teach the principles of preparing human foods from soybeans. Emphasis is placed on the wide assortment of innovative food products that can be made from the whole bean, thus fully using its high protein and calorie content.

The course covers small-scale industrial processing of whole soybeans into human food and preparation methods based on home and village technology. Throughout the course, participants are introduced to currently available soyfoods and to new products with future potential. Participants will conduct experiments in the laboratory and pilot plant, and study the Sri Lankan

soybean-processing industry through visits to soybean-processing and food-manufacturing companies.

INTSOY staff and members of the Soyabean Foods Research Centre will teach the course at the Soyabean Foods Research Centre, Gannoruwa, Sri Lanka.

The course fee is US\$2,000. Each participant should bring US\$1,000 to cover living expenses during the course.



INTSOY's short course on soybean processing emphasizes small-scale and village technology for processing whole soybeans into human foods.

**Participants in all short courses** must arrange their own financial support. Neither INTERPAKS nor INTSOY have scholarships to offer. In the past, sponsors have included employers, governments, and international agencies such as the World Bank, IFAD, FAO, USAID, UNDP, various foundations, and regional development banks. Participants are expected to understand, read, write, and speak English.

The course fee covers training costs, university health services, transportation during the course, computer access, and instructional materials. International travel and living expenses are not included in this fee. Housing is available in a dormitory on campus or in local hotels.

### Special Courses and Workshops

INTERPAKS and INTSOY can organize short courses and workshops specifically designed to meet your training needs. INTSOY

courses deal with all phases of soybean processing. INTERPAKS courses revolve around improving the effectiveness of the agricultural research/extension/farmer relationship, and could include management, extension methods, training methodology, and communication techniques.

Courses can be held on the UIUC campus, where the amenities of a large university campus — faculty expertise, technical information, and facilities — are available. They can also be held in-country or in association with national or international research centers, tailored to fit the specific conditions of a given country or region.

**For more information** about the courses, please write to INTSOY or INTERPAKS, 113 Mumford Hall, 1301 West Gregory Drive, Urbana, IL 61801, USA; telex 206957. The telephone number for INTSOY is 217-333-6422 and the telephone number for INTERPAKS is 217-333-5831. □

## Mailing List Revision

**W**e are revising the mailing list for the *International Agriculture Update*. To continue receiving this newsletter, please send us your current mailing address before June 1987. Use the card enclosed or send us a note at the Office of International Agriculture, 113 Mumford Hall, 1301 West Gregory Drive, Urbana, IL 61801, USA. Your readership is appreciated. □

## International Enrollment

**T**here have been international students on campus since the university was founded. Their presence enriches the educational, research, extension, and international programs at UIUC and leads to improved cross-cultural understanding and a broader perspective on the global food and agricultural system.

In the 1986 fall semester, there were 230 international graduate and undergraduate students from fifty-two countries enrolled in the College of Agriculture and the College of Veterinary Medicine. Nearly 24 percent of the graduate students enrolled in veterinary medicine and 31 percent of the graduate students enrolled in agriculture were international students.

How did we compare with other units on campus? Agriculture and veterinary medicine hosted nearly 11 percent (230 individuals) of the degree-seeking international student population on campus.

Looking at UIUC as a whole, there were 2,133 international students, comprising 6 percent of the UIUC total enrollment of 36,330 students. Most international students (89 percent) were studying at the graduate level. □

### International Student Enrollment at UIUC, Fall 1986

UIUC campus unit	Number of international students		
	Graduate	Undergraduate	Total
Liberal Arts and Sciences	548	93	641
Engineering	483	45	528
Commerce	275	35	310
Agriculture	197	11	208
Fine and Applied Arts	121	31	152
Education	124	5	129
Applied Life Sciences	28	5	33
Communications	26	0	26
Veterinary Medicine	22	0	22
Law	31	0	31
Other units	52	1	53
<b>Total</b>	<b>1,907</b>	<b>226</b>	<b>2,133</b>



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COLLEGE OF AGRICULTURE

1987 Vol.2, No.4

## World Food Day

In more than 140 countries, World Food Day will be observed on October 16, the anniversary of the establishment of the Food and Agriculture Organization (FAO) of the United Nations. The purpose of this day is to increase public awareness of the world food situation and to generate national and international support for the struggle against poverty, hunger, and malnutrition.

This issue of the *International Agriculture Update* is dedicated to World Food Day. We are pleased that it features guest articles by Edouard Saouma, Director General of FAO; Duane Acker, Director of Food and Agriculture, U.S. Agency for International Development; and Stanley O. Ikenberry, President of the University of Illinois. We hope that this issue will give you, our readers, additional insights into the problem of world hunger and how various organizations and institutions are addressing it. □

*John J. Nicholaides III*  
Director, Office of International Agriculture



A world without hunger? The ability of a nation to feed itself is critical to world peace, economic development, and sustained well-being. In developing countries, the development of the agricultural sector is basic to national development — a development that is essential for trade and that enables increases in per capita consumption, improves the quality of life, and provides a sense of security absent in a subsistence economy.

## IDAT: A Partnership Between Kenya and Illinois

The University of Illinois at Urbana-Champaign (UIUC) and Egerton University (EU), Njoro, Kenya, are participating in a long-term collaborative project called IDAT (Institutional Development for Agricultural Training). This five-year project began in 1986 with funds from the U.S. Agency for International Development.

IDAT has a twofold purpose: to help strengthen and expand Egerton University into a major regional center for agricultural training, adaptive research, and educational outreach; and to establish a permanent institutional relationship between UIUC and EU. IDAT will provide a gateway to the resources, faculty, and programs of each partner and to other universities and private and governmental organizations in the United States and Kenya.

**Egerton legacy.** Egerton University is located about 192 kilometers (120 miles) northwest of Nairobi, on the Western rim of the Rift Valley. Egerton College was founded in 1939, when Lord Egerton of Tatton deeded 405 hectares of land (1,000 acres) for the establishment of an agricultural college. Upon his death in 1958, an additional 1,215 hectares of his estate (3,000 acres) went to the College.

Since independence in 1963, Egerton has grown steadily, both in the number of students and in curricula. By the mid-1980s, 1,600

students from Kenya and other countries in Africa were enrolled in three-year diploma programs. With 14 academic departments in the faculties of agriculture, basic sciences, education and human resources, and economics and social sciences, this institution was given autonomous university status in 1987 and renamed Egerton University.

**Kenya today.** Located on the east coast of Africa, Kenya straddles the equator. Climate varies with altitude: the coastal zone is hot and humid; the highlands and western areas receive plentiful rainfall; and the northern part is very dry. A former colony of Great Britain, Kenya became independent on December 12, 1963, and a republic exactly one year later.

Kenya's prosperity is primarily based on the production and processing of agricultural products: about 85 percent of the population relies on agriculture for its livelihood. Kenya is the leading producer of tea in Africa; coffee, pineapple, pyrethrum, sisel, and wattle are also important cash crops. Other important agricultural products include maize, wheat, barley, sorghum, and millet. Kenya is one of the few countries in Africa with an important dairy industry. Livestock farming varies from the pedigree stock-raising on the Highland farms to the traditional herding of the Masai tribes.

The high rate of economic growth achieved in the decade after independence has slowed. Moderators of progress include an annual population growth rate of about 4 percent, which is the highest in the world, a high rate of inflation, problems of unemployment, and unequal distribution of wealth.

**Linkages.** The chief vehicle for making the Egerton-Illinois relationship work is a system of

linkages involving representatives from both partners. The formal mechanism is through a faculty liaison committee from each campus, representing key academic and administrative leaders. Working together, these two committees provide each other with systematic access to the resources and programs of their institutions and to broader national operational resources and other public and private institutions in both countries.

In December 1986, six members of the Egerton faculty liaison committee came to the Urbana-Champaign campus to get acquainted with their Illinois colleagues and the institutional resources that would be available to Egerton. In January 1987, eight members of the Illinois liaison committee traveled to Egerton for a reciprocal visit. Future visits by each are anticipated.

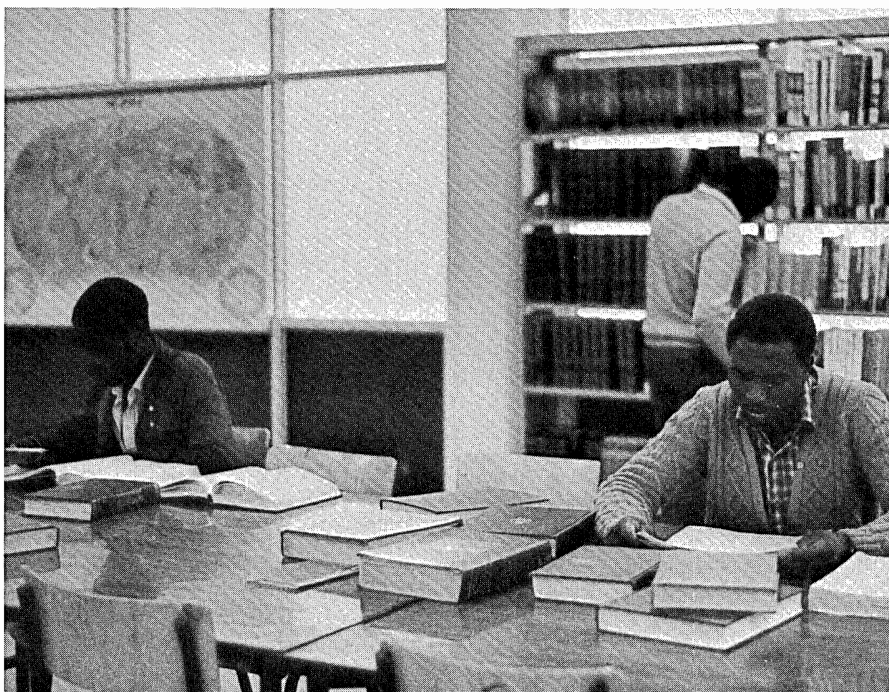
In addition to the exchange of faculty committees, executive visits are planned for 1987. A group from EU visited UIUC in September, and a group from UIUC will travel to Kenya in November to participate in the formal inauguration of Egerton University.

**IDAT.** IDAT is designed to strengthen Egerton University as an agricultural educational institution of excellence that serves the needs of Kenya and other African countries. Its four major components are curriculum development and evaluation; administration and management improvement; faculty and staff development; and educational materials, research, and outreach.

**Curriculum development and evaluation.** This important component will help Egerton initiate a number of new degree programs in agricultural and related sciences. As each department at Egerton considers the courses that must be organized and taught, faculty members from both campuses are exchanging course outlines and teaching materials. Also, a number of internal and external committees are being established. These committees will maintain the academic rigor of each curriculum and ensure relevance to the personnel needs of both the public and private agricultural sectors in Kenya.



Through the IDAT partnership, UIUC hopes to help strengthen and expand Egerton University into a major regional center for agricultural training, adaptive research, and educational outreach for Kenya. Another goal is to establish an on-going institutional relationship between UIUC and Egerton University.



Students in the reference room of the library. At Egerton, library development needs to keep pace with university expansion. The long-range plan emphasizes developing services to faculty members and students and building a journal collection to support agricultural research and degree programs.

In the process of curriculum development, UIUC is assisting with three studies. Two involve the design and use of exit questionnaires for all graduating students and tracer or follow-up studies of former graduates. These studies will systematically obtain the views of students about the value and relevance of their education and training right after graduation and then a year or two later, when they are employed. A third study, to be initiated in 1987, will focus on the current and future needs of the agricultural sector for graduates from Egerton and determine which skills and knowledge employers view as essential for various jobs.

**Administrative and management improvement.** This component involves incorporating computers into the administrative functions of the University. Two primary areas identified for computerization include student admissions and records, and accounting and finance. Microcomputers will also be introduced

into related units and into the Agriculture Resources Center, Tatton Demonstration Farm, and Guildford Dairy Institute.

In addition, computers will be available for faculty research, and a 21-unit microcomputer teaching laboratory will be established to teach basic computer literacy and agricultural applications. A wide range of software for word processing, data management, statistics, and agriculturally related subjects will be available to faculty and students.

**Training and faculty development.** This is a central component of the IDAT project. The seven members of Egerton's faculty who started graduate education programs in January 1987 were joined by five other faculty members in August 1987. Additional faculty members will start graduate programs in upcoming semesters. As part of its investment in the partnership, UIUC is providing Egerton faculty members with at least ten tuition and fee waivers each year for study at Illinois. In

addition, UIUC is providing key administrative personnel from Egerton with up to five administrative internships each year to see how counterpart staff at Illinois manage and carry out similar support functions.

**Educational materials, research, and outreach.** The final component is wide ranging. An Educational Materials Center is being established to improve the quality of instructional materials for Egerton and eventually for other agricultural education institutions and programs in Kenya and in Eastern and Southern Africa. Scheduled to begin operation in 1988, this center will produce a variety of teaching aids and instructional modules. A basic desk-top publishing system with off-set printing capabilities will be installed.

Another dimension is the sabbatical-scholar program. To enhance research activities in Egerton University, each year ten faculty members from U.S. universities will be selected to undertake sabbatical leaves at Egerton. During their academic year at EU, they will teach part-time, assist with curriculum and course development, conduct research, and generally participate in and contribute to the academic development of their respective departments. Also, UIUC doctoral students will conduct dissertation research and teach at Egerton.

Two rural development laboratories — one in the area surrounding the campus at Njoro and the other about 97 kilometers (60 miles) north of Njoro near Egerton's field station at Chemeron — will be focal points of faculty research and outreach. These laboratories will give faculty and students experience conducting on-farm research, developing production recommendations, and trying different extension strategies and demonstration techniques. This experience will

supplement on-campus research and will help solve on-farm problems through an active outreach program.

This outreach program will center around further development of the Agriculture Resources Center (ARC), a hotel-conference facility located on campus. The ARC is already an active facility that hosts a continuing stream of conferences and workshops for Ministry of Agriculture personnel, agribusiness managers, and others. It is used frequently as a venue for regional workshops for the Food and Agriculture Organization of the United Nations (FAO), the International Service for National Agricultural Research (ISNAR), and other organizations.

A final dimension of this project component is development of the library. Modest resources are available to initiate this plan; additional funding will be needed to implement comprehensive development of the library. With the assistance of UIUC, Egerton will identify donors and solicit funds to help strengthen the library's facility and collection. Another facet of library development is collecting, sorting, pack-

ing, and shipping books and periodicals donated to EU by retiring UIUC faculty members. Many back issues of valuable periodicals have already been donated.

**Peace Corps link.** A special facet of the IDAT project is a small program with the Peace Corps. Four Peace Corps volunteers, three with doctorates in the agricultural sciences, began teaching at Egerton in August 1987. These volunteers and others will help meet the shortage of faculty members that will occur when the University expands and when Egerton faculty members are on study leave in the United States.

**Gateway.** IDAT is seen as a challenge for Illinois faculty, students, and other agriculturalists to access the many educational opportunities in Kenya and other countries in Africa. For more information about IDAT call or write Burton E. Swanson, 113 Mumford Hall, 1301 West Gregory Drive, Urbana, IL 61801, USA; telephone 217-333-5834; telex 206957 (intag urba); Dialcom E-mail number 57:AGS770. □

## United States Links with FAO

### Edouard Saouma

There have been strong links between the United States and the Food and Agriculture Organization (FAO) since the decision was made in 1943 to establish an international organization to support the development of agriculture and fight malnutrition. The direct result of an initiative by President Franklin D. Roosevelt, FAO was established in October 1945, eight days before the United Nations came into existence. In its early days, before moving to Rome in 1951, FAO was housed in offices provided by the United States Department of Agriculture.

Besides being the largest single contributor to the budget of FAO, the United States is the world's largest single food aid donor. Each year it provides some 7 million tonnes of food aid to developing countries, enough food to sustain a basic diet for almost 50 million people. Despite this aid and the efforts of FAO and other aid agencies, millions of people still go hungry, particularly in developing countries.



An important part of the economy, livestock farming varies from the traditional herding of the Masai tribes to the pedigreed stock-raising on Highland farms. Through classes and practical experience, students at Egerton University learn how to help meet the needs of Kenya's farmers.



Training and education provide the basis for the most successful and enduring international agricultural development efforts and have a vital role to play in supporting self-reliance in food for developing countries. The University of Illinois has made training a cornerstone of its international development activities. Shown here is a group of international trainees at UIUC's Morrow Plots, the oldest continuous experimental agricultural fields in the United States.

**Paradox of hunger and abundance.** Forty years ago there were hungry people throughout war-ravaged Europe as well as in Africa, Asia, and Latin America. Since then, the world population has more than doubled, and food production has increased even more rapidly. Several countries now hold surpluses of grains, milk, meat, and butter. These surpluses are so large that the European Economic Community (EEC), like the United States, is looking for ways to dispose of them and even to reduce food production.

**Role of education.** Probably the most important factors explaining this dramatic leap forward in production have been the development of science and technology and its transfer and application by trained people. I am proud of the role FAO has played and continues to play in this endeavour.

Such progress would not have been possible without an expansion and improvement of education. In the United States, roughly one person in twenty is a university graduate. By contrast, in some countries of Africa the figure is less than 1 in 1,000.

Education has a vital role to play in supporting self-reliance in food for developing countries. The ultimate aim of all assistance programs is to eliminate the need for assistance. This is why each year FAO provides training courses for more than 60,000 people from developing countries.

**Eliminating hunger.** The main thrust in the battle against malnutrition and hunger must be to help developing countries increase food production to keep pace with their rising populations. The number of malnourished people continues to rise. According to the Fifth World Food Survey

undertaken by FAO in 1985, about 400 million people do not have enough food. Over the next 40 to 50 years, the population in developing countries will double to more than 6 billion.

Responsibility for raising food production and productivity rests mainly with the governments of the countries concerned. But their efforts must be supported by a substantial increase in the flow of resources from developed countries, from North to South. A recent FAO study concluded that without such an increase, by the end of the century the food supply position would deteriorate in 64 developing countries.

Increased food production is not the sole solution to the problem of hunger. The root cause of hunger is poverty. Income inequality, lack of employment, and abject poverty in many developing countries deprive millions of people of the means to purchase sufficient food for a basic diet.

The elimination of hunger requires that all people at all times are able to produce or purchase their basic food needs, as emphasized in the FAO World Food Security Compact. We are a long way, however, from achieving this goal. Abundance and malnutrition will exist side-by-side for a long time to come. FAO estimates show that in 1986 food consumption per person fell in nearly half of the deficient, low-income countries.

**World economic climate.** The difficulties confronted by developing countries are compounded by a difficult world economic climate. Although inflation has eased and interest rates have fallen, in most industrialized countries growth levels remain disappointing. Unemployment rates refuse to decline, and several nations are running budget deficits of alarming proportions.

World agricultural trade remains in a state of crisis. Total earnings from agricultural exports

in 1986 were 10 percent less (in current U.S. dollars) than total agricultural export earnings at the beginning of the 1980s. Measures have been introduced by many industrialized countries to insulate domestic markets for food and agricultural products from world market forces. The total government expenditure on agricultural support and export subsidies by the EEC, Japan, and the United States will probably exceed US\$70 billion this year. This is equivalent to the total earnings from all agricultural exports of all the developing countries.

Many developing countries are struggling to import less and export more. The cost of debt-servicing continues to grow, whereas the prices of their export commodities fall. In 1986, for example, export prices of food commodities were almost 12 percent below the depressed levels of 1985.

Developing countries are caught in a vice, and its grip is closing. If nothing is done to remedy this situation, how can the economies of developing countries escape this gradual strangulation?

**New approach needed.** I believe that a visionary approach to tackling the foreign indebtedness of developing countries should be at the top of any international agenda. Many developing countries have had to make radical structural adjustments in their economies, which may be a necessary foundation for noninflationary recovery. I believe, however, that these changes are politically and socially tenable only in the context of sustained economic expansion. They cannot and should not be applied blindly. Rather, they should be moderated to protect the most vulnerable groups and particularly to improve their access to food.

If the current world economic environment is unfavorable for developing countries, the long-

term outlook is also bleak. Recent studies by FAO, the U.N. Conference on Trade and Development, and the World Bank suggest that the prices of most agricultural commodities will probably remain low in the interim, whereas those of most manufactured goods will continue to rise. Thus, a further worsening of the terms of trade of commodity exporters is in prospect.

**Long-term solution.** Against this background, is there any hope of a major improvement in the living standards of the billions of people in developing countries? I believe there is, but it requires concerted international action on a number of fronts.

First, creditor nations need a visionary approach to the crippling burden of debt held by developing countries. In addition to the cancellation of some debts and more favorable repayment terms on others, the conversion of debts to equity may be a solution in some cases. This approach would be in the long-term interests of both developed and developing nations.

Second, the position of the developing countries in world trade must be strengthened. In the long

term, trade is more important than aid as a tool for economic development. The trend toward protectionism must be resisted. The current round of GATT negotiations provides both a challenge and opportunity to the international community.

Prices of agricultural commodities on international markets must rise and stabilize at levels that cover costs. At present, farmers worldwide are unhappy with the low prices of most agricultural commodities. A step in the right direction would be to call a halt to the predatory use of export subsidies, whose main effect is to depress international prices.

Third, developing countries must make greater efforts to increase food production. With external assistance, such efforts should make it possible to increase production to keep pace with population growth and increase self-reliance in food.

Finally, international aid to food and agricultural production must be expanded rapidly. At present, official development assistance is increasing by less than the rate of growth of industrialized countries. Worse yet, total external aid to



Children weeding crops in Indonesia take time out to pose for a photograph. The rapidly increasing world population is straining resources in many countries, causing deterioration of the environment, increasing erosion from overgrazing and misuse of land, and causing a decline in an already marginal standard of living. During the last decade we created surpluses of food and feed crops although the number of malnourished and starving people remains needlessly high. To maintain global standards, we must improve nutrition and education; balance food and energy needs with resources; practice stewardship of land and water resources; insist that government agencies, academia, and industry coordinate their efforts to apply agricultural technology to benefit farmers; and develop long-range policies for food and energy.

agriculture has remained practically unchanged and soft loans have dropped sharply. This pattern must be reversed if the specter of increasing poverty, malnutrition, and famine is to be avoided.

**A world free of poverty.** In conclusion, I would stress that helping the developing countries achieve the economic transformation they need so desperately is not an act of charity. Markets in developed countries will expand only slowly. The best long-term hope for growth of world demand for both capital equipment and manufactured goods rests in the developing countries of Africa, Asia, and Latin America.

But if these countries are to increase their imports, they have to be able to expand their exports. The future of industrialized countries is inextricably linked to the prospects of developing countries, which depend on international stability and the elimination of tensions.

The eradication of poverty, malnutrition, and hunger is in the interest of both developed and developing countries, and it is a prerequisite for international peace. Therefore, I am confident that the world will eventually find the political will to cooperate in solving the greatest challenge to humanity today.

Each of us must help to achieve this goal. Even as we approach the twenty-first century, in many developing countries there are millions of starving people. All of us can, and must, seize every opportunity to ease this burden, even if only in a small way. I want to assure you that FAO will continue to play its part vigorously. ■

*Edouard Saouma is Director General of the Food and Agriculture Organization of the United Nations (excerpted from his commencement ceremony address to the Catholic University of America, Washington, D.C., May 16, 1987).*



The College of Agriculture has a long and proud history of involvement in international agricultural activities and programs. In this photograph from the mid-1960s, Professor Edwin Bay (center) is discussing practices for the new, high-yielding dwarf wheat varieties with Ghenda Singh (third from left), the Minister of Agriculture in Uttar Pradesh. Continuing our commitment to the fight against hunger, UIUC participates in institutional and agricultural development projects in developing countries. We must work together to change this world from one with hunger and poverty to one with hope and dignity for all people.

## The Challenge of Being a World-Class University

Stanley O. Ikenberry

**W**e hear a great deal these days about competitiveness, about trade deficits, and about slumping agricultural exports. We hear less about international cooperation and about how higher education in the United States — given the mandate to public universities — remains uniquely committed to our responsibilities beyond our borders. Surely, we must find ways in and outside of agriculture to compete. Just as surely, we must cooperate globally, because a poor and hungry world is an unstable world.

This is a good time both to remember our roots and to contemplate our future.

• This year we mark the 125th anniversary of the Morrill Act,

which established the land grant university system in the United States — a distinctively American contribution to the world of higher learning.

• This year is the centennial of the Hatch Act, passed by the Congress of the United States to encourage the development of agricultural experiment stations at state land grant schools.

• This year we celebrate the centenary of the National Association of State Universities and Land-Grant Colleges (NASULGC), the oldest association for higher education in the nation. Institutions belonging to NASULGC award 60 percent of all doctorates in the United States. It soon will be 40 years since NASULGC made

a formal commitment to assist the Government of the United States in overseas technical assistance.

• This year is the twentieth anniversary of the founding of the Office of International Agriculture in the College of Agriculture, although the college has been active in the international arena since the early 1900s. The director of the Office of International Agriculture is also associate dean of the college and assistant vice-chancellor for research at UIUC—clear signals of the importance we place on international affairs.

We have much to cheer about. Our national network of land grant colleges and universities defined for the United States a fundamentally new approach to higher education: access to education was to be determined by ability, not by personal wealth or family circumstance. New curricula joined the classical disciplines of the time. Science and technology, agriculture, the mechanical arts — now called engineering — and several professions were not only tolerated but promoted. These are now so well established that we take them for granted.

These land grant institutions have not been, are not, and should not become isolationist any more than the nation should become protectionist. Decades of work by people from our College of Agriculture in Kenya, India, Indonesia, Jordan, Nepal, Pakistan, Peru, Sierra Leone, Yugoslavia, Zambia, and elsewhere are important. Indeed, scientists in agriculture and throughout the University are engaged in cooperative research with colleagues in most countries of the world. Research and education are not bound by geography.

As Henry Nau, a professor of political science and international relations at George Washington University, has said, the world as a whole is a better place for the sweeping changes in the global economy: "We have built a world

system where we are now beginning to bring into membership at the highest levels countries which 25 years ago were in poverty."

We have not damaged our export markets by teaching other nations how to improve their agricultural systems. Instead, the international agricultural development activities in which U.S. universities participate have helped strengthen the economies of developing countries, bringing them into the world economy, and making them our fastest growing market. We must learn to market aggressively and just as forcefully work together to build a better future and a better world.

The success of "Food for Century III" and the promise of the Plant and Animal Biotechnology Laboratory have cast the University of Illinois in a national leadership role to create new products and processes that can restore the competitiveness of U.S. agriculture. We can fulfill this challenge. The enduring marriage of teaching and research — the discovery of new knowledge and its transmission — and the concept of public service remain a part of the land grant, public university heritage that is upheld by the University of Illinois and other great universities across our land. □

*Stanley O. Ikenberry is President of the University of Illinois.*

## Aid, USAID, and U.S. Agriculture

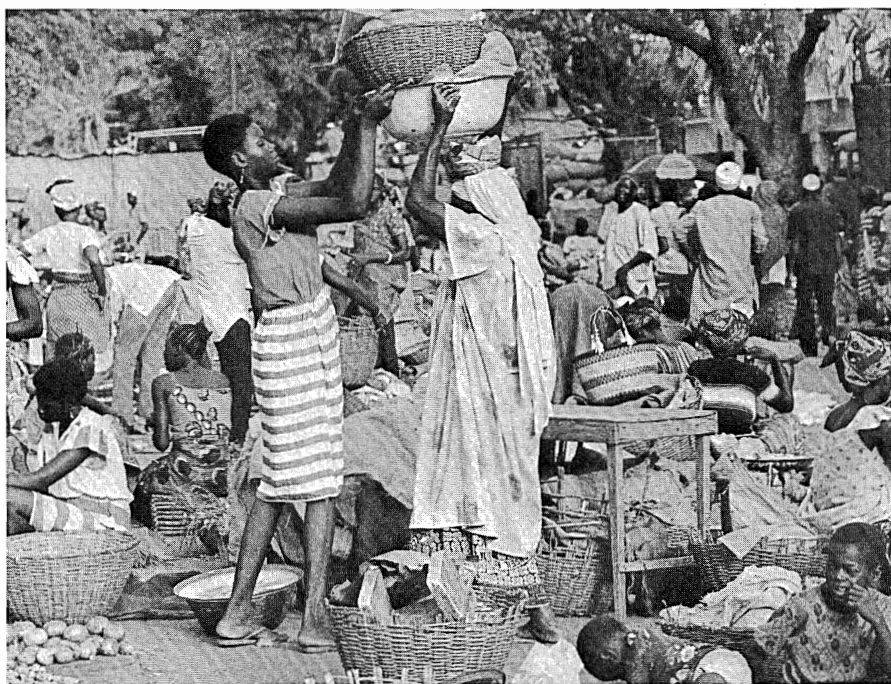
Duane Acker

Some people are well acquainted with the positive impact that U.S. technical assistance and multilateral loans have had on the economic growth of developing countries and the resultant increase in U.S. exports to those countries. There are other people, however, who question the rationale for aid in light of the serious economic problems currently experienced in U.S. agriculture.

U.S. technical assistance projects did not cause the sharp drop in exports of U.S. commodities experienced since 1981. Factors that did contribute to the decline include: the prolonged high value of the dollar; reduced economic growth; the heavy debt load of low and middle income countries; an increase in agricultural production from 18 to 60 percent since 1975 in Argentina, Australia, Canada, China, and the European Economic Community (EEC); high farm subsidies in EEC countries; pricing U.S. grain above world levels; and import duties and other constraints.

Bilateral and multilateral grants and loans should be given to developing countries to address humanitarian concerns and to foster country, regional, and world stability. In addition, economic assistance develops active participants in international trade and helps maintain political friendships, especially in the case of bilateral aid.





Market scene in Burkina Faso. There is no better or quicker way to foster the economies of developing countries than by developing agriculture. From the late 1960s to the late 1970s, the 29 developing countries with the fastest growth rates in basic food staple production increased their imports of basic food staples by 360 percent. Photo by Norma Holt.

**Economic growth and U.S. exports.** Despite the drop since 1981, both developed and developing countries increased their imports of U.S. agricultural products between 1974 and 1985. When tabulated in dollars and by percentage, developing countries had a greater net increase in imports than did developed countries. Furthermore, those developing countries that increased their per capita production of agricultural commodities the most rapidly also increased their purchases of U.S. agricultural products the most rapidly.

One success story we would like to see repeated is that of South Korea. In 1954, South Korea was suffering from severe economic problems. The United States and other donors and lending agencies helped small-scale Korean farmers become more productive. The universities and the extension system were strengthened. Rice varieties were developed that produced more grain, and Korean pricing policies were developed

that stimulated food production by small-scale farmers.

Many donors and lending agencies were involved. It took a long time, but consider the results. Between 1971 and 1983, per capita agricultural production in Korea increased 27 percent. Average annual commercial imports of U.S. agricultural products increased from US\$197 million in 1971 to US\$1.7 billion in 1983 — an eight-fold increase. In 1971, the U.S. government supported an average of US\$171 million worth of agricultural exports; by 1983 these were replaced by US\$1.7 billion commercial sales.

**Five principles.** There are five principles that apply to the development of Third World countries. These are, at the same time, reasons for developing the agricultural base of those countries.

1. Poor people and poor countries do not buy much. Only those with cash or good credit are good customers. The United States, and especially its agricultural economy, needs customers with healthy, growing economies.

2. Strengthening and increasing the productivity of that part of the private sector that employs the most workers in a developing country will usually produce the most rapid economic growth. Agriculture, the economic base of most developing countries, employs from 50 to 85 percent of the workers. Therefore, development of agriculture in those countries is an essential first step to their total development, that is, increasing their gross national product, wealth, and purchasing power.

3. Improved nutrition improves productivity. It enhances energy levels, ingenuity, and motivation. Initially, improved nutrition usually occurs closest to where the food is produced. Families on small farms that produce good harvests eat a better diet. These farms have excess produce to send to the market, and the broader population benefits from the availability of more food. That broader population becomes more productive, and a ripple effect is

Table 1. U.S. Agricultural Exports

Countries	Year			Net Increase	
	1974	1981	1985	Dollars	Percent
— US\$ billions —					
Developing	7.61	18.24	12.92	5.31	70
Developed	13.95	25.54	18.27	4.32	31

Source: United States Department of Agriculture, Economic Research Service. U.S. Foreign Agricultural Statistics.

felt in retailing, manufacturing, and services. As purchasing power grows, it generates demand for both food and nonfood items.

4. As income goes up, diets diversify. With higher incomes, people want a better diet. This desire often is reflected in the demand for meat by rural as well as urban families. Requiring large volumes of coarse grains and protein sources, meat production contributes significantly to the demand for U.S. grain and soybean exports.

5. As economies develop, countries increase both imports and exports. Exports are essential to help finance imports.

These principles briefly describe the phenomenon mentioned earlier: developing countries that increased per capita food production the most rapidly also increased their imports of U.S. agricultural products most rapidly. When developing countries increase their exports, however, some of those exports will be agricultural commodities. Nevertheless, we need to remember that, as in the case of Korea, the net effect on U.S. agricultural exports has been positive.

This development, moreover, eventually may contribute to some shifts in U.S. production patterns, not uncommon in the history of U.S. agriculture. In our lifetime, cattle feeding has shifted from the Corn Belt to the High Plains, cotton from the Southeast to the Southwest, egg production from the Upper Midwest to Georgia and Arkansas, and cow herds to the Southeast. Soybeans are now produced on land in the Corn Belt that once produced oats and on land in the South and Southeast that produced cotton.

### **Technology for agriculture.**

To successfully meet existing and future competition from both developed and developing countries,

U.S. agriculture must have access to all possible technology and genetic materials. Much of the world's genetic material is found in developing countries. The flow of genetic material and technology from developing countries and international research centers significantly benefits U.S. agriculture.

For instance, most of the genes that provide resistance to downy mildew, head smut, anthracnose, charcoal rot, and grain rot in grain sorghum hybrids grown on the U.S. Great Plains came from native sorghum materials in Africa and India. The germplasm was manipulated through collaborative research involving African, Indian, and U.S. research institutions and financed in part by the U.S. Agency for International Development (USAID).

Another benefit is the resistance of U.S. potatoes to golden nematode. The genetic sources of this resistance came from Peru. Genetic resistance to leaf blight, rust, and dwarf mosaic in U.S. corn hybrids, which has come largely from tropical germplasm through collaborative research, is another example.

Technical assistance, like multilateral loans, is of mutual benefit to the United States and developing countries. A collaborative research project on small ruminants, financed by USAID and involving U.S. universities and institutions in developing countries, has established that the arthritis-encephalitis virus of goats is easily spread through colostrum. It had been common practice in the United States and other countries to pool colostrum to provide enough for all kids in a herd, thus spreading the virus to all of the next generation.

Another instance of this mutual benefit is the International Laboratory for Research on Animal Diseases (ILRAD), financed in part by USAID. This laboratory is located in Nairobi, Kenya, because of the presence and seriousness of

tick-borne diseases in Africa. Researchers at ILRAD have been able to clarify genetic and cellular paths to immunity, providing principles and mechanisms for animal selection and breeding systems as well as for the development of vaccine systems that can be applied to control livestock diseases in the United States.

**USAID.** USAID celebrated its 25th anniversary in 1986. The focus of USAID's agricultural programs is "to increase the income of the poor majority and expand the availability and consumption of food, while maintaining and enhancing the natural resource base."

Allied to the U.S. State Department, USAID has mission offices and staff in about 70 countries. These are grouped into three geographical bureaus: Africa, Latin America-Caribbean, and Asia-Near East.

USAID activities in Washington, D.C., are divided into six functional bureaus. Science and Technology provides research and technological support to missions and their programs. Food for Peace and Voluntary Assistance handles Food for Peace; cooperative work with CARE, Helen Keller International, and other private voluntary organizations; and grants to American schools and hospitals abroad. The bureau of Private Enterprise helps involve the private sector of both the target country and the United States in projects. Program and Policy Coordination sets policy and decides how resources are allocated. The final two bureaus, External Affairs and Management, are primarily administrative.

**Agriculture is the key.** While we try to address the immediate problems of U.S. agriculture, at the same time we must do all that we can to build future markets and future competitiveness. The inherent capacity of U.S. agricultural

land and the significant impact agriculture has on the U.S. economy require that we keep at least one eye on the future.

It is in the long-term interests of U.S. agriculture for the United States to continue its bilateral and multilateral investments in the development of Third World countries. Because poor countries do not buy much, it behooves us to do all that we can to develop the economies of the Third World countries. In that effort, development of their agriculture and increased food consumption are important and necessary steps.

Because U.S. agriculture is so dependent on exports, we must maintain and strengthen our competitiveness. To do that, we must continue the flow of genetic material and technology through worldwide collaborative research. The fact that our exports are in trouble today underscores the need to recognize the successes of past development investments and the potential for future successes. □

*Duane Acker is Director for Food and Agriculture, United States Agency for International Development. Former positions include President at Kansas State University, Vice Chancellor at the University of Nebraska, and Dean of Agriculture at South Dakota State University.*



Grain exported from the United States is unloaded at facilities such as this one in Germany. Illinois markets are now inextricably a part of the international agricultural community. To expand trade, we must understand our market and offer high-quality products at competitive prices. Photo courtesy of the American Soybean Association.

## European Economic Community Grain Quality Project

**D**uring the past five years the United States has become increasingly aware of the importance of the quality of U.S. grain and soybean exports to the European Economic Community (EEC). Most of the maize exported by the United States to the EEC is processed by wet millers, dry millers, feed manufacturers, and Scotch whiskey distillers. Soybean crushers and feed manufacturers are the main processors of soybeans.

In 1985, Jeanne Bailey and Karen Bender, two graduate students from the Department of Agricultural Economics at UIUC, spent three months in Europe examining the demand for U.S. maize and soybeans by five industries. They worked under the supervision of Lowell D. Hill, professor of agricultural marketing.

In addition to data on demand for U.S. maize and soybean exports, they also collected information on quality characteristics.

This two-part study was conducted through a combination of mail surveys and personal interviews at processing firms. Because of the large number of processors in the EEC, it was not possible to interview each one. Most of the data was collected through mail surveys. Developed at UIUC, the surveys were designed to obtain information on the amounts of maize and beans processed, the origins of their supply, and quality characteristics specific to maize and soybeans that are important to the end user.

The surveys were sent out from the Institut de Gestion Internationale Agro-Alimentaire, an

agricultural university in Cergy-Pontoise, France, which was the base of operations for the overseas portion of the project. More than 800 surveys were mailed to processors in the member countries of the EEC (Belgium-Luxembourg, Denmark, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, and the United Kingdom), as well as to Austria, Switzerland, and Scandinavia.

The information gathered from interviews complimented the data collected from the mail surveys. Interviews were conducted at the five largest firms in each industry to obtain qualitative information on maize and soybeans and to gather in-depth information on general processing techniques. In addition to meetings with processors, interviews were conducted with EEC policy specialists and U.S. agricultural attaches to get a balanced overview of the entire EEC grain and oilseed processing industry. In the course of the survey, more than thirty personal interviews were completed in nine countries. Overall, the response to the survey and interviews was very positive.

Important quality characteristics for maize and soybeans vary by industry. For example, wet millers manufacture starch, so they want maize that has a high starch content; but dry millers make maize flakes, so they need maize that has low breakage susceptibility. Feed manufacturers request maize and soybeans with high protein content for the feed mixes, whereas the soybean crushers want soybeans that have both high oil and protein yields.

In general, the results indicated steadily declining U.S. maize exports to the EEC in the face of their increasing domestic production. Total EEC imports of maize fell from 16.4 million tonnes in 1977 to 3.3 million tonnes in 1985. The U.S. share of those imports fell from 87 percent to less than 20 percent. As long as the EEC

agricultural policy continues to subsidize domestic production, U.S. maize export levels will probably not increase much, and may well decline further.

U.S. soybean exports, in contrast, have not declined as dramatically. Some of the decline can be attributed to the increase in EEC oilseed production, which is also subsidized. Total EEC imports of soybeans fell from 11.7 million tonnes in 1974 to 10.0 million tonnes in 1985. U.S. exports of soybeans to the EEC hit a high of 11.3 million tonnes in 1979, dropped to 6.7 million tonnes in 1984, and then rose to 8.9 million tonnes in 1985. The future for U.S. soybean exports to the EEC is somewhat more encouraging than it is for maize exports because few oilseed substitutes have the high level of protein found in soybeans.

The project shed light on which quality characteristics are important for each industry. In addition, the study was useful in describing how demand in the EEC for U.S. maize and soybean exports has varied in the past six years. Although the short-run demand for U.S. maize and soybean exports to the EEC may not change, the grain quality project opened lines of communication that may be useful in facilitating future efforts to study the situation of U.S. exports. □

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# INTERNATIONAL AGRICULTURE

UNIVERSITY OF ILLINOIS  
AT URBANA-CHAMPAIGN

COLLEGE OF AGRICULTURE

1988 Vol. 3, No. 2

Update



We are all human beings and, as such, brothers and sisters to each other. Peace on earth will never be achieved as long as a fourth to a third of humanity lacks the basics of life: adequate diets, a clean environment, education, employment, health care, and shelter.

## Rewarding Excellence

Comparable to the Nobel Prize, the General Foods World Food Prize is awarded annually to an individual who has significantly improved the world's food supply and helped alleviate hunger and malnutrition. It was awarded for the first time in October 1987.

This issue of the *International Agriculture Update* salutes the Prize, its sponsor, the General Foods Fund, Inc., and the first recipient of the prize, M. S. Swaminathan. We are pleased that it features guest articles by Robert McC. Adams, secretary of the Smithsonian Institution; Norman E. Borlaug, 1970 winner of the Nobel Peace Prize; A. S. Clausi, chair, Council of Advisors, General Foods World Food Prize; John Denver, former member of the Presidential Commission on World and Domestic Hunger; Robert D. Havener, president of Winrock International Institute for Agricultural Development; and Dr. Swaminathan.

Conquering world hunger and poverty, its primary cause, is a battle not yet won. The security afforded by a life without poverty and hunger is the basis for a life of hope and dignity; only then will we see the chance for a lasting world peace. ■

John J. Nicholaides III  
Director, Associate Dean, and  
Assistant Vice-Chancellor for Research

## General Foods World Food Prize

A. S. Clausi

*...to recognize and reward those men and women who have made outstanding contributions to expanding and improving the quality, quantity, and availability of food throughout the world.*

The General Foods World Food Prize is the foremost international award for outstanding individual achievement in improving the world food supply. The award was conceived by Norman E. Borlaug, an eminent agricultural scientist whose research in plant genetics and its application earned him the Nobel Peace Prize in 1970.

Awarded for the first time in 1987, the annual prize carries a cash award of US\$200,000 and a commemorative piece symbolic of the prize. The prize is funded by the General Foods Fund, Inc., a nonprofit tax-exempt foundation supported entirely by General Foods.

General Foods hopes that the prize will serve both as a reward and as an example to others that solutions to world food problems are possible. Despite the great advances that have been made through science and social policy, malnutrition and hunger create extreme hardships for millions of people.

The quest for food dominates the lives of most people around the world. More than 75 percent of the world's population live in less developed countries where food problems are a major concern. Without a safe, wholesome, and abundant supply of food, individuals and entire nations forfeit a life of hope and dignity. Wars have been waged over food, and even today the economies of many countries hang in the balance, awaiting an ample harvest.

It is no wonder that improvements in the food supply profoundly affect most nations. But it is not enough merely to produce more food. The food must also be available to every person in affordable, nutritious, and appetizing forms.

The concept of the total food chain lies at the heart of the General Foods World Food Prize. Each link in that chain plays a vital role. Every aspect of producing, processing, and distributing food needs to be considered, including farming, the agricultural sciences, food science and technology, nutrition and economics, technology transfer, governmental policies, transportation and distribution, and education.

**1987 laureate.** It is fitting that the first prize was awarded to Dr. Monkombu Sambasivan Swaminathan, one of the world's leading agricultural scientists. His career as a scientist, educator, administrator, and humanitarian has enriched the lives of individuals and entire populations across the globe.

Dr. Swaminathan is widely recognized as the architect of the Green Revolution in India, which radically improved agricultural yields through the introduction of genetically superior, high-yielding varieties of wheat and rice. In the 1960s, as a cytogeneticist and administrator of the Indian Agricultural Research Institute, he made many scientific advances that

pioneered solutions to major agricultural problems in Asia. The Green Revolution that began in India subsequently swept South-east Asia.

By taking this new information to farmers at their level with field demonstration plots, Dr. Swaminathan bypassed the stumbling block of illiteracy and converted a generation of Indians to belief in the effectiveness of modern agriculture.

The laureate is noted for his understanding of the breadth of entire food systems. During his service in government, he established programs for ecological rehabilitation, rural development, and technological development. His programs effectively helped subsistence farmers reap their fair share of credit and income while conserving national resources.

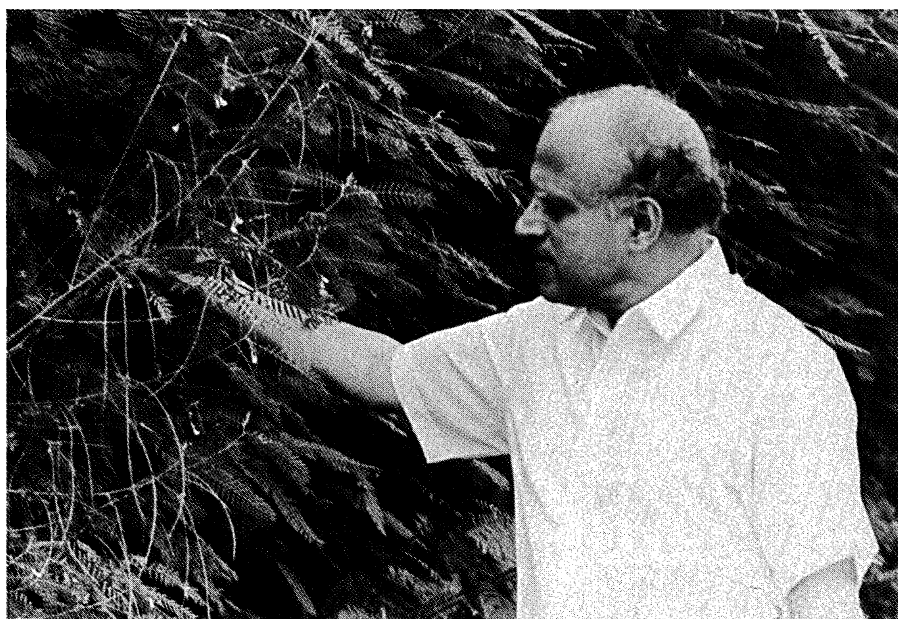
From 1982 to his retirement early in 1988, Dr. Swaminathan served as director general of the International Rice Research Institute (IRRI) in Los Banos, Philippines. At IRRI, more than 600 researchers from around the world work to increase yields of

rice, one of the world's most important crops.

IRRI released the first improved rice varieties in the mid-1960s; today farmers grow improved varieties on 55 percent of rice lands in the Third World. Their increased production feeds 650 million more people than earlier varieties would have been able to feed.

Born in Kumbakornam, Tamil Nadu, India, Dr. Swaminathan received a B.Sc. from Travancore University in 1944, a B.Sc. in agriculture from Coimbatore Agricultural College, Madras University, in 1947, and a Ph.D. in genetics from the School of Agriculture, Cambridge University, in 1952. Since then, he has received honorary doctorates from 25 institutions.

Recognition by scientific societies includes the Indian National Science Academy, the Royal Society of London, and academies of agriculture and science in Italy, the Soviet Union, Sweden, and the United States. Dr. Swaminathan has received many awards for research and



M.S. Swaminathan, former director general of the International Rice Research Institute (IRRI), Los Banos, Laguna, Philippines, was named the first laureate of the General Foods World Food Prize. Dr. Swaminathan was cited for his exceptional contributions to world agricultural research and the alleviation of hunger in the world. Photo courtesy of IRRI.

leadership, including the Albert Einstein World Award on Science, the first award given by the Association of Women in Development, and the Padma Shri and Padma Bhushan awards from the President of India.

Dr. Swaminathan has proven that he is not only a brilliant scientist, but a capable administrator as well. His infectious enthusiasm and love of humanity have inspired and motivated thousands of others to give whole heartedly to the cause he has chosen for his life's work: humbly serving the rural poor. ■

*A. S. Clausi is chairman of the Council of Advisors, General Foods World Food Prize, and senior vice president, retired, General Foods Corporation.*

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Hunger robs millions of individuals of the opportunity to lead fuller lives. Although we know that there is no valid excuse for the existence of hunger, we still lack the political will to remove this stigma from our civilization.

## Let Us Begin

### John Denver

**W**hat does it take for us to begin to work together?

A few years ago we were momentarily successful dealing with the famine in Africa. We may no longer see front-page stories about this obscenity in our lives, but the problem remains. No other disaster in our history compares with hunger. Every day 35,000 people starve to death. Some 13 million of our brothers and sisters starve to death every year. Yet, we do almost nothing about hunger.

I was privileged to serve on the Presidential Commission on World and Domestic Hunger set up by President Carter. The commission found not only that we can end hunger on our planet, but also that in doing so we would accomplish more for peace in the world and for our own national security than we could ever accomplish militarily.

In a speech to the national press in 1953, President Eisenhower said "Every gun that is made, every warship launched, every rocket fired signifies, in the final sense, a theft from those who hunger and are not fed, those who are cold and are not clothed. This World in Arms is not spending money alone. It is spending the sweat of its laborers, the genius of its scientists, the hopes of its children....This is not a way of life at all in any true sense."

We are facing an unprecedented challenge in human history, which is also an unprecedented opportunity: we can effect changes in our human condition. Everyone can play a critical role and that is why I am so committed to this cause. We can end hunger on planet Earth. We can live in peace and prosperity. ■

*Entertainer and song writer John Denver participated in the General Foods World Food Prize award ceremony. He is cofounder of the Windstar Foundation, a nonprofit educational center for programs on renewable energy, food production technology, land stewardship, global resource management, and conflict resolution. (From selected writings of John Denver, with permission from Windstar Journal)*



Too many agricultural plans developed by agricultural organizations in countries in Asia and Africa do not mention the word "farmer." All the other ingredients are there - credit, farm implements, fertilizers, irrigation, pesticides, and seeds - but not the human beings who will use all these inputs.

## Our Common Agricultural Future

M. S. Swaminathan

**T**o achieve enduring food security, we must overcome environmental challenges, establish symphonic agricultural systems, and free the world from hunger.

**Overcoming environmental challenges.** First, we need to give priority to fighting the ecological fires that are raging in most parts of the world. Developing countries are ravaged by deforestation, desertification, demographic pressures, soil erosion, and water pollution. Environments in developed countries suffer from acid rain, atmospheric pollution, contaminated water, environmental mutagens and carcinogens, and toxic waste.

Loss of biological diversity, destruction of the ozone layer, possible climatic changes from the accumulation of carbon dioxide in the atmosphere and from the rising temperatures of the oceans, and other phenomena will affect

us all — regardless of the problem's geographic origin. It is alarming that we are not fully aware of the scope and impact of the ecological fires that affect our basic life-support systems — the atmosphere, fauna, flora, land, and water. Some encouraging signs are emerging: the development of a plan for the rehabilitation of degraded tropical forests and the protocol signed recently by 24 nations for limiting the use of chemicals that destroy the ozone. We need to support these types of international cooperation.

We must respond to these environmental challenges by adopting measures for maintaining biological diversity and ecological processes. Planning and managing irrigation systems, promoting the growth of natural forests, and conserving the entire system of production from upstream forests to downstream fisheries are vital for ensuring a secure system for food and livelihood.

The ecological fires that can destroy the livelihoods of generations yet to be born cannot be put out in a day, a month, or even a year. Extinguishing them requires long-term commitments and innovative approaches. Assistance for reforestation, soil conservation, and other measures often is not available in seasons when there is adequate moisture in the soil. Fifteen years ago I pleaded for a strategy for undertaking ecological rehabilitation programs in years with normal rainfall. Unfortunately, national and international aid disappears when the rains come.

**Establishing symphonic agricultural systems.** Equally important is the promotion of what I call symphonic agricultural systems, which are based on the integrated principles of ecological sustainability, economic viability, and equity. Production, marketing, and consumption are components of a symphonic agricultural research and development program.

The system is designed to promote growth without losing stability. Frequently, the concept of sustainable agricultural production is used to preserve the status quo or revert to outmoded production technology. We need a dynamic concept of sustainability to help meet the needs of an expanding population while maintaining and enriching the natural resource base.

In most developing countries, the two major pathways to the production of additional food are greater productivity and more intense cropping. Many developing countries, fortunately, have the ability to increase both yields and the intensity of cropping with the technology currently available to them. Small-scale farmers in countries with chronic food shortages have been able to double average yields when given an optimum blend of three elements — appropriate technology, services, and



supportive government policies. Norman E. Borlaug and his colleagues are demonstrating this in several African nations with food deficits.

Some people are critical of high-yielding varieties of cereals because small-scale farmers cannot afford to purchase the nutrients needed to maximize yields. Adequate inputs are essential for high yields, but what is not commonly known is that even with low levels of added nutrients, the new varieties may give higher yields than the old strains. High-yielding varieties of rice, wheat, and other crops often are more efficient in producing grain than the traditional cultivars. Thus, the smaller the farm, the greater the relevance of high-yield technology.

The quality of life of small-scale farmers can be improved through more efficient use of credit, labor, land, water, and other available resources. To understand the objective of enhanced efficiency in the management of small farms, a distinction should be made between a small farm and a small-scale farmer. A small farm is ideal for adopting knowledge-intensive technology. A small farm family, however, suffers from many economic and social handicaps. Often small-scale farmers in developing countries do not have access to land ownership or tenurial rights, extension assistance, timely and adequate supply of inputs, and assured and remunerative marketing opportunities. These are problems that can be solved only by political leaders.

Scientists should bring the best in science and technology to upgrade, on a sustainable basis, the productivity of small farms. Political leaders and administrators should ensure that all farmers profit from new technology. By failing to recognize this distinction, critics of high-yielding varieties harm millions of small-scale farmers of the Third World.

**Freeing the world from hunger.** Why have we been unable to free the world from hunger? The problem has to be approached both in terms of production and consumption.

**Production.** Political leaders tend to take a short-term view of long-term problems: they are interested in crash programs for agricultural production that are launched with a good deal of political fanfare. The human beings whose toil is vital to the success of these programs are generally ignored. It is not surprising that many of these programs collapse after wasting scarce resources.

I have come across too many agricultural plans developed by agricultural departments in countries in Asia and Africa that do not mention the word "farmer." These plans include raising the level of production. All the other ingredients are there — credit, farm implements, fertilizers, irrigation, pesticides, and seeds — but not the human beings who will use all these inputs. When the term "farmer" is finally used, it is mostly taken to mean men. Seldom does it include female farmers and farm labor. Yet, we suspect women played the leading role in the domestication of plants more than 12,000 years ago. In most developing countries, women perform key functions in food production, organic recycling, postharvest conservation, and seed selection. Also, the poorer the household, the greater the need for women to have access to independent income.

**Consumption.** These government plans frequently set targets for yield, but seldom a minimum target for the income of farming families. Public and private sector employees are always concerned with their net take-home pay, continuously adjusted against inflation. But the same officials, when formulating policies for the farm sector, do not think that

small-scale farmers in the self-employed sector deserve a minimum take-home pay. A minimum income level for families engaged in rural occupations also ensures an adequate flow of resources to the villages and helps correct imbalances in trade between the farm and nonfarm sectors.

In this context, I would like to pay tribute to the government of President Corazon C. Aquino of the Philippines, whose policies for agricultural progress are designed to increase, in real terms, the income of Philippine farmers from about US\$60 per month in 1987 to US\$100 per month by 1992. Unless we can reorient the thinking of governments along these lines, we will always have politicians and professionals talking about the untapped potential of their countries but doing nothing to realize it.

We should constantly remind ourselves that hunger robs millions of individuals of the opportunity to lead fuller lives. Today, although we know that there is no valid excuse for the existence of hunger, we still do not know how to remove this stigma from our civilization. I suggest three lines of action to supplement present efforts.

**A World Without Hunger Olympics.** First, we need to make people aware that we can create a truly joyful world, where not a single person spends the night hungry. How can we inform enough people in a way that will have an impact? Television is the communication medium of choice. If more than two billion people around the world can watch on TV the Olympic games or the World Cup football tournament, can we not also show them a World Without Hunger Olympics? Countries and organizations would demonstrate their methods for making food accessible to everyone.

I appeal to the General Foods Fund to take the lead in organizing these Olympics. A global event

like this might be organized every two years with the help of other national and international organizations committed to promoting ecological and food security. Among them are the Better World Society, the Hunger Project, the International Council of Scientific Unions, the International Union for the Conservation of Nature and Natural Resources, the UN/FAO World Food Programme, UNICEF, and the Worldwide Fund for Nature.

### **Farmer-scientist ventures.**

Second, we must develop a mechanism through which scientists and farmers from different countries can share experiences and know-how. Currently, there are peasant-to-peasant organizations, and scientists have many opportunities to meet and exchange ideas. The communication revolution we are witnessing now will increasingly facilitate continuous intellectual interaction across continents and reduce the need for formal conferences.

What is missing, however, is a mechanism for promoting projects between scientists and farmers. With their joint involvement, agricultural research could bridge the growing gap between knowing and doing, thereby accelerating the pace of development and diffusion of location-specific technology.

### **Country-specific programs.**

Finally, we need intervention programs tailored to meet the specific needs of countries where hunger is prevalent. Amartya K. Sen, professor of economics and philosophy at Harvard University, has shown in several of his books and articles how well-designed public intervention that enhances entitlements can reduce or eliminate hunger and expand life expectancy. Agrarian reform and schemes that guarantee employment are important for these two objectives.

The challenge lies in developing strategies at the national level for using food and commodity aid in a way that will help end the need for such aid, not perpetuate dependence and erode self-reliance. UNICEF, the World Food Programme, and other international organizations as well as bilateral and national organizations have had considerable experience in using aid in this manner. Analyzing this experience, we can prepare strategies for initiating appropriate "Food for Self-Reliance" and employment guarantee programs.

To sum up, I plead for coordinated, nongovernmental initiatives to generate awareness by using the power of the mass media. Farmers and scientists must work together to analyze and solve field problems, and we must use increasing global grain surpluses to enable all those who need help to earn their daily bread. ■

*The first laureate of the General Foods World Food Prize, Monkombu Sambasivan Swaminathan recently retired as director general of the International Rice Research Institute, Los Banos, Philippines. Former positions include secretary to the Government of India, Ministry of Agriculture and Irrigation; and director general, Indian Council of Agricultural Research.*

## **Science, Ethics, and Food**

**Robert McC. Adams**

**A** year before the first World Food Prize was scheduled to be awarded, the Smithsonian Institution was approached by the General Foods Fund about organizing a scholarly colloquium on global food issues that would take place at the time of the presentation of the award. It seemed a timely opportunity for us to solicit the wisdom of people from a number of different fields and try to address in some modest way the heartbreaking problems that stare at us from the pages of our daily newspapers. We organized not only a colloquium on the subject of "Science, Ethics, and Food," but also arranged to have the World Food Prize presented at the Smithsonian.

With the assistance of colleagues at Winrock International Institute for Agricultural Development, and with generous financial support from the General Foods Fund, we succeeded in gathering together a diverse and distinguished group of government leaders, policymakers, food scientists, scholars, and food industry representatives from around the world. Quite apart from the papers and the formal discussion following them, the gathering provided an opportunity for this group to interact, to establish or renew contacts, and to exchange ideas informally.

Four outstanding figures were our featured speakers: Father



A distinguished group of government leaders, policymakers, food scientists, scholars, and food industry representatives from around the world gathered together for the colloquium on global food issues that took place at the time of the presentation of the first General Foods World Food Prize. Both the colloquium and presentation were held at the Smithsonian Institution in October 1987.

William J. Byron, president of the Catholic University, Washington, D.C., who reflected on "The Protection and Promotion of the Right to Food"; Thomas R. Odhiambo, director of the International Center of Insect Physiology and Ecology, Nairobi, Kenya, who examined "The Innovative Environment for Increased Food Production"; Amartya K. Sen, professor of economics and philosophy at Harvard University, Cambridge, Massachusetts, who approached the problem of access to food in "Food Chains and Entitlement Problems"; and John W. Mellor, director of the International Food Policy Research Institute, Washington, D.C., who drew the various threads of our colloquium subject together in his paper, "Towards an Ethical Redistribution of Food and Agricultural Science." Serving as moderators for the first day's discussion were Jessica Tuchman Mathews, vice president and research director of the World Resources Institute, Washington, D.C., and Robert Paarlberg, associate professor of political science at Wellesley College, Wellesley, Massachusetts.

On the day following the presentation of colloquium papers

and the World Food Prize, Dr. Swaminathan chaired a session designed to draw conclusions and recommend what steps might be taken to confront the critical food problems facing the world today. A summary of these comments will be included in the colloquium proceedings, which will be published this autumn by the Smithsonian Press.

**Long-term problem.** Although it was encouraging to observe the earnestness and pragmatism with which food issues were addressed throughout the colloquium, the information and ideas exchanged were indeed sobering. In spite of successes like those celebrated by the World Food Prize, recurrent famine and unremitting malnutrition remain virtually as widespread and dangerous as ever.

In Dr. Odhiambo's colloquium paper, for example, we are quietly warned of the downward trends in African food production that have taken place during essentially the same period that has seen the triumphs of the Green Revolution in southern and southeastern Asia. Noting institutional deficiencies and shortages of trained scientists

and specialists in Africa, Dr. Odhiambo drew our attention to the devastating illnesses that are endemic to the continent and have prevented agricultural exploitation of large areas of land. Without a revolution in rural health care, he told us, no long-term, sustainable system of agricultural production will be possible.

At the same time, the problems of African agriculture cannot be solved quickly with an influx of technology. Although the Green Revolution has raised hopes about the power of technology to solve our agricultural problems, what is needed in Africa are low-input, low-cost solutions that incorporate, rather than abandon, local subsistence practices and resources. Exporting technology alone, in other words, will provide no answer. Western scientists and agronomists have a great deal to learn before they will have anything to teach.

### **Dilemmas in agriculture.**

There are reasons to be wary of the proposition that the agricultural sector in the West is troubled only by overproduction, and that we could help meet the challenge in Africa. A recent overview (*Bio-science* 36(1):29-39) calls attention to a number of disturbing trends that have accompanied the increasing dominance of agribusiness in the United States. By 1981, 25,000 large-scale farms with annual sales of \$500,000 or more accounted for almost two-thirds of total net income.

Farming has become a relatively minor and subordinate part of the agricultural system. In little more than a generation, the farmer's share of the retail price of a loaf of bread has dropped by more than half to under 8 percent. Breeding programs that formerly were largely financed publicly have been eclipsed by privately financed advances in biotechnology. This shift further encourages factorylike production and creates the

prospect of the linked marketing of agricultural chemicals and compatible seeds.

Although positive in many respects, these developments direct us away from Africa's — and to some extent the world's — emergent needs. Agricultural experiment stations are induced to abandon varietal breeding and to concentrate on the handful of crops that dominate world markets. Research on minor crops dwindles in spite of its importance not only for Africa but also for retaining the long-term protection of biodiversity.

Operators of smaller family farms continue to be driven out of agriculture and into the labor market. Where will we find people with either the teaching or learning skills that the next great phase of the Green Revolution will surely require?

Unfortunately, troubling situations like this, whether in the West, in Africa, or in Asia, often do not receive the attention they merit until circumstances approach crisis proportions. The World Food Prize was established in part to focus the attention of our policy-makers and public on the world food situation. Such broad problems cannot be properly addressed, however, until they are clearly articulated and formulated in terms that draw upon a broad range of disciplines, perspectives, and arenas of action. Because of the international and multidisciplinary scope of Smithsonian activities and collections, we have long taken more than a theoretical interest in issues. It was, therefore, appropriate that the Smithsonian should provide a forum for the wide-ranging examination of food issues in the "Science, Ethics, and Food" colloquium. We hope that this gathering was the first of many. ■

*Robert McC. Adams is secretary of the Smithsonian Institution.*



Norman E. Borlaug, who has been called the father of the Green Revolution, was awarded the Nobel Peace Prize in 1970 for his work in breeding high-yielding varieties of wheat. His scientific contribution was significantly complemented by his leadership in gaining the rapid adaptation and adoption of the new wheat varieties and accompanying technology. Photo courtesy of CIMMYT.

## Agriculture in the Third World

### Norman E. Borlaug

Picture the annual world harvest of cereal grains as a highway of grain circling the earth at the equator. This imaginary highway would be at least 20 meters wide, 2.5 meters deep, and a little over 43,500 kilometers long (65 feet wide, 8 feet deep, and 27,000 miles long). The world's people consumed this entire harvest last year. This year the highway of grain must be completely reproduced and another 1,050 kilometers (650 miles) must be added to its length just to feed the growing world population at the same, often inadequate, level. More than half of this food and 80 percent of the additional food requirements each year will be consumed in the less developed countries of Africa, Asia, and Latin America, where more than 3.75 billion of the world's 5.0 billion people live.

World food production of all types is today about 4 billion tonnes and includes about 2 billion tonnes of edible dry matter. Of this total, 99 percent is produced on the land; only slightly more than 1 percent comes from the oceans and inland waters. Plant

products constitute 93 percent of the human diet, with about 30 crop species supplying most of the world's calories and protein. These include eight species of cereals, which collectively supply 52 percent of the total world food supply.

Until the mid-1960s, very little agricultural research was conducted in developing countries on the major food crops. The network of international agricultural research centers, established over the past two decades to work on the major food crops and farming systems of the developing world, has been important in stimulating agricultural research in the Third World. The improved varieties and production practices developed by scientists at the International Maize and Wheat Improvement Center (CIMMYT) in Mexico and the International Rice Research Institute (IRRI) in the Philippines, in conjunction with researchers in developing countries, did much to avert the specter of famine for millions of people in the 1960s and 1970s.

**The Green Revolution.** The introduction of high-yielding

varieties of wheat and rice, the application of fertilizer, and the use of other improved agronomic practices that permitted the genetic expression of high-yield potential have significantly helped to transform food production in Asia, the world's most populous continent. Although large-scale farmers in favorable production environments were the first to benefit from the technology generated by the Green Revolution, they were soon followed by small-scale farmers.

Today, Asian farmers are harvesting nearly twice as much wheat and rice — 250 million extra tons annually — as they did two decades ago. Coined the Green Revolution, this transformation has few parallels in the history of agriculture, other than perhaps the spread of hybrid maize in the United States during the 1940s and 1950s.

**New Green Revolutions needed.** Despite the tremendous increases in food production in Asia, the Middle East, and parts of Latin America in recent years, agriculturalists today face even greater production challenges to feed future generations. New Green Revolutions must occur in the more marginal production areas of Asia, Sub-Saharan Africa, and parts of Latin America. These areas are generally rain-fed environments that suffer from moisture and temperature stresses, soil fertility problems, diseases and pests, and other difficult production conditions.

**Some lessons learned.** How can we help ensure that these new Green Revolutions in food production will indeed occur? In reflecting on my more than 40 years of personal experience in attempting to assist developing nations improve the productivity of their agriculture, I have learned certain lessons that bear directly on the challenge ahead.

**Agricultural sectors are exploited.** Despite the fact that 50 to 80 percent of the total population in the Third World directly engages in agriculture and animal husbandry, the agricultural sector in virtually all developing nations is exploited for the benefit of the minority in the urban sector. Relatively low priority is given to investments in crop research, water resource development, rural roads, input delivery systems (for seed, fertilizers, pesticides), credit, and grain storage facilities.

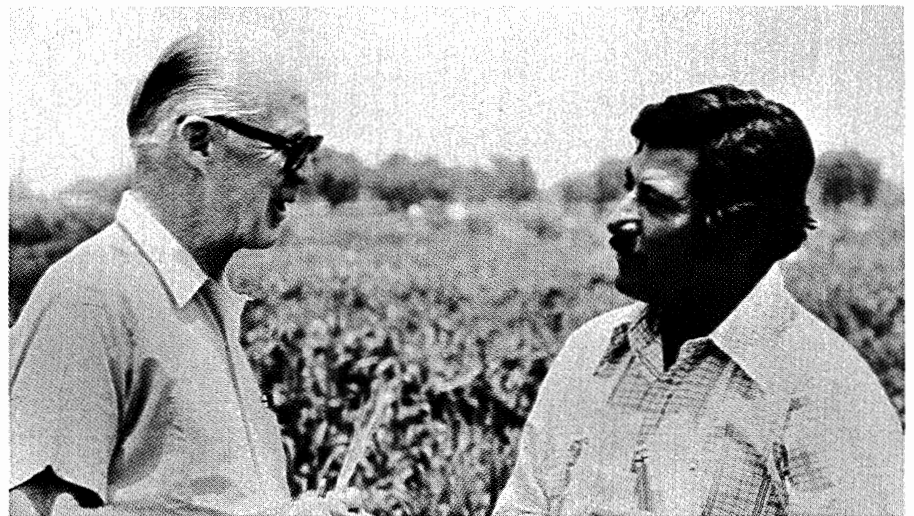
This exploitation is also manifested in government policies to keep food prices low to placate the better-organized urban sectors. Too often, these policies are reinforced by easy-term food aid and surplus disposal programs sponsored by food-exporting nations. Such policies have time and again retarded agricultural development in food-deficit, developing nations. Obviously, food aid is another matter in emergencies caused by droughts, floods, frosts, disease epidemics, and other natural disasters.

**Improved technology is needed.** A low-yield, stagnant, traditional agricultural system cannot be transformed into a high-yield, productive system without

the development and widespread application of improved technology. An aggressive, interdisciplinary research effort is essential for this development. The new technology and practices must have the potential, when properly applied, of increasing yields on farmers' fields by at least 50 percent. Moreover, this increased yield must be achieved within acceptable levels of risk for the farmer. Appropriate economic policies are also essential for persuading farmers to shift to improved technology.

**Continuity is required.** Effective research programs that are capable of developing useful methods and materials for revolutionizing crop production require continuity both in scientific personnel and program objectives. Generally a minimum of six to eight years of creative, dedicated, and adequately supported research work in various disciplines are required to improve varieties and gather information for improved production practices.

The refinement and transfer of appropriate production technology require the skill of integrators, agricultural scientists who are also interested in increasing agricultural production to serve human



Borlaug, pictured here at CIMMYT, the International Maize and Wheat Improvement Center in Mexico, is a strong advocate of transferring research findings to farmers through extension activities. An important part of Borlaug's work focuses on teaching young scientists his techniques. Photo courtesy of CIMMYT.

needs. Once developed, the production technology must be tested on many farms and modified as necessary to reduce the risk to farmers as much as possible.

Research integrators must also be able to anticipate and sense when political leaders are willing — often because of serious, pending food shortages — to make important changes in agricultural development strategies. Often at such moments a scientist can best convince national leaders to put into place the three economic elements needed to stimulate the agricultural sector: the availability at reasonable prices of fertilizers and other necessary production inputs, credit for small-scale farmers before the sowing season, and adequate prices at harvest that are announced before the planting season. With these pieces in place, an aggressive, well-publicized national production campaign can be launched with support from the staff of the agricultural extension service.

**Link to research is crucial.** Agricultural extension programs in developing nations often have been accused of not transferring improved technology from experiment stations to farms, thereby contributing to the perpetuation of low yields and, in turn, worsening food shortages. In most cases, the so-called new technology emerging from experiment stations was not economically workable or was incapable of increasing yields adequately within acceptable levels of risk to the farmer. The result is agricultural stagnation and, in fact, often a reduction in per capita food production.

Clearly, the development of an agricultural extension service that is not closely linked to a dynamic research system has little to offer farmers in the way of improved technology. With the development of national research and production systems, however, I am confident that agricultural extension systems in developing countries can become

more effective in the years ahead. Also encouraging is the growing trend for at least part of the new technology to be developed on the fields of farmers who will use it.

**What the United States can do.** The United States can and must play a critical role in solving the dilemma of hunger and poverty in the Third World. First, as the largest food exporter, the United States will continue to serve as the world's breadbasket. Even though there is an oversupply in international grain markets today, U.S. farmers will eventually see considerably greater world demand for their agricultural products. Second, the United States has done more than any other country to transform its agriculture into a dynamic, highly efficient production system. Through scientific institutions like the University of Illinois and our foreign aid program, we will have an even larger role in future years to help assure the agricultural development of the poor, food-deficit nations of the world.

The lack of continuity in many U.S. technical assistance programs has seriously affected the payoffs from past efforts. One of the main reasons is that the turnover of expatriate scientific staff is too rapid. Assignments of two to three years are of little value to the host country. A minimum of three to five years are required for visiting scientists to familiarize themselves adequately with the agricultural problems, language, and culture of a new country and to contribute productively to agricultural development.

The motivation for U.S. technical assistance, moreover, has included self-interest as well as humanitarian objectives. In this increasingly interdependent world, no country — however rich and abundant in resources — can exist as an island unto itself. Today, international trade is essential to the economic well-being of

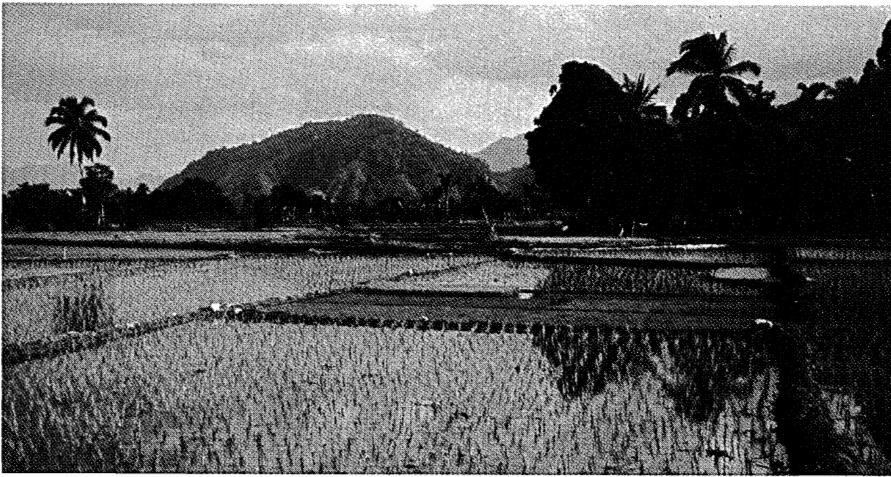
every nation; history has proven that chronically food-deficit, low-income countries do not make dynamic trading partners.

Furthermore, peace on earth will never be achieved as long as a fourth to a third of humanity lacks the basics of life: adequate diets, education, employment, health care, pure water, and shelter. As we should know by now, overpopulation, poverty, and hunger are the breeding grounds for revolution.

**Cautious optimism.** I believe that if proper emphasis is given to agriculture and if sound financial policies are established and implemented, adequate food production can be maintained during the next doubling of the world's population. This task will require far fewer words and sensationalized reports and much more research, action, and production. Producing more food and fiber and protecting the environment, moreover, can at best be only a holding operation until we tame the "population monster."

The attitudes of scientists, political leaders, and the general public will determine whether we reach or fail to reach the targets for food production needed to sustain world civilization. Should we fail in this endeavor, our accomplishments in all other walks of life will be irrelevant and foolish. ■

*Norman E. Borlaug is distinguished professor, Department of Soil and Crop Sciences, Texas A&M University, College Station, Texas; former director of the wheat program at the International Maize and Wheat Improvement Center (CIMMYT) in Mexico; and the 1970 recipient of the Nobel Peace Prize. (Excerpted from Illinois Research 27(1):25-27)*



The adoption of high-yielding varieties of grain and improved production practices, now known as the Green Revolution, did much to avert the specter of famine for millions of people in the 1960s and 1970s. Today, farmers grow improved varieties of rice on 55 percent of rice lands in the Third World. Their increased production feeds 650 million more people than earlier varieties would have been able to feed.

## Scientists: Their Rewards and Humanity

Robert D. Havener

As a rule, the accomplishments of outstanding agricultural scientists are rewarded primarily by such things as peer recognition, plaques, and honorary degrees, not monetary prizes. The first and, until now, only exception to this generality was Norman Borlaug, wheat breeder at the International Maize and Wheat Improvement Center in Mexico and 1970 winner of the Nobel Peace Prize. His contribution to the advancement of science came through breeding short, stiff-strawed, fertilizer-responsive varieties of wheat and developing the production agronomy that permitted them to express their high genetic yield potential. His scientific contribution was significantly complemented by his leadership in gaining the rapid adaptation and adoption of the new wheat varieties and accompanying technology, particularly in Mexico, India, and Pakistan.

A key scientist in the adaptation and adoption of technology in India is M. S. Swaminathan. This recently retired director of

the International Rice Research Institute (IRRI) in the Philippines was named the first winner of the US\$200,000 General Foods World Food Prize, which was awarded during ceremonies at the Smithsonian Institution on October 6, 1987. For more than a quarter century, Dr. Swaminathan has been a major force in shaping India's policies in agriculture on an ecologically and economically sustainable basis. As a geneticist, he worked on the development of strains of wheat, rice, and coarse grains that would grow well in the ecological settings of India. His untiring work and dedication to the prevention of famine and amelioration of hunger in his homeland and the Third World have helped to generate self-confidence in the agricultural capabilities of the Third World. Just as Norman Borlaug is regarded worldwide as the father of the Green Revolution, M. S. Swaminathan has been called the father of India's Green Revolution.

Establishment of the World Food Prize did not just happen. Following his worldwide recognition as a Nobel laureate, Dr. Borlaug worked

diligently to get appropriate monetary recognition for other scientists working in the field of food and agriculture. He first tried the Nobel governing group but found that, after establishing the Nobel Prize in Economics, the group resisted awarding further specialized prizes. Undeterred, he continued to seek support for a major prize that would recognize other food and agricultural scientists. His efforts were rewarded by the initiation of the World Food Prize by the General Foods Fund, Inc. The purpose of the prize is twofold: to give recognition to scientists for outstanding contributions to the quantity, quality, or availability of food and to stimulate talented young women and men to seek careers in some link of the food chain.

Dr. Swaminathan has effectively championed causes beyond the realm of science. For example, he has recognized the important role of women in agriculture in developing countries. "In the ultimate analysis," he wrote, "the goal of scientific research is to enhance human happiness. This is why IRRI accords importance to equity issues in technology generation and transfer. An important initiative in this field is greater attention to the problems of women farmers as well as women laborers in rice farming areas. Evidence suggests that when women have independent access to income, child nutrition is improved. The poorer the household, the greater the need to increase total family income by enhancing the earning capacity of women."

Dr. Swaminathan followed up his words by establishing the Asian Rice Farming Network, which has examined the effects on women of technological change in rice-based farming systems; designed, tested, and adapted technologies to reduce drudgery and increase women's incomes by creating more opportunities for them to earn money; and identified gaps in input-delivery

systems and government policies that hamper women's full participation in developing and adapting technology.

With the establishment of the World Food Prize, exceptional scientists such as Norman Borlaug and M. S. Swaminathan can be

properly recognized for their achievements and for extending their influence to benefit humanity.

*Robert D. Havener is president of Winrock International Institute for Agricultural Development, Morrilton,*

*Arkansas, and former director general of the International Maize and Wheat Improvement Center (CIMMYT) in Mexico. (Modified from: Robert D. Havener, "Scientists: Their Rewards and Humanity," Science 237:1281; September 11, 1987, AAAS) ■*

## The Prize

**G**overnance. The Council of Advisors, a select group of internationally recognized authorities, is the ultimate authority in establishing policy regarding the General Foods World Food Prize. Council members represent a wide variety of sciences, disciplines, and professions relevant to food policymaking, research, production, processing, and distribution.

The Council of Advisors is limited to eight members. Appointments are made by General Foods, in consultation with distinguished outside experts.

Current members of the Council of Advisors and their institutions are:

*A. S. Clausi*, chairman, senior vice president and chief research officer, retired, General Foods Corporation, White Plains, New York, USA;

*Norman E. Borlaug*, distinguished professor, Department of Soil and Crop Sciences, Texas A&M University, College Station, Texas, USA;

*Ricardo Bressani*, head, Division of Food and Agriculture Sciences, Research Coordinator, Instituto de Nutricion de Centro America y Panama, Guatemala City, Guatemala;

*David L. Call*, dean, School of Agriculture and Life Sciences, Cornell University, Ithaca, New York, USA;

*Thomas R. Odhiambo*, director, International Center of Insect Physiology and Ecology, Nairobi, Kenya;

*Richard L. Hall*, vice president, Science and Technology, McCormick & Company, Inc., Hunt Valley, Maryland, USA;

*Robert D. Havener*, president, Winrock International Institute for Agricultural Development, Petit Jean Mountain, Morrilton, Arkansas, USA;

*Pekka Linko*, Department of Chemistry, Helsinki University of Technology, Espoo, Finland.

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*The purpose of the prize is twofold: to give recognition to scientists for outstanding contributions to the quantity, quality, or availability of food and to stimulate talented young women and men to seek careers in some link of the food chain.*

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**Administration.** The Secretariat, Winrock International Institute for Agricultural Development, is responsible for administering the General Foods World Food Prize and following the policies set by the Council of Advisors. Winrock International is a private, nonprofit institution whose mission is to alleviate poverty and hunger through agricultural development.

**Nomination and selection.** The deadline for nominations for this annual award is December 31. The award is presented the following October. Nominations remain active for three years.

Individuals whose efforts have substantially improved the quality, quantity, or availability of food may be nominated as candidates by any private or public institution. Institutions are not eligible. The award is made without regard to race, color, religion, national origin, age, sex or sexual persuasion of nominees.

All nominations are reviewed for appropriateness and completeness by the Secretariat. Nominations are then forwarded to the Selection Committee with recommendations.

The Selection Committee is composed of nine distinguished individuals who represent many cultures. Committee members are knowledgeable about nutrition; producing, processing, and distributing food; research; policy development; and business management.

It is the committee's responsibility to review and assess the nominations and to select the candidate most worthy of the award in accordance with the stated objectives. Members of the Selection Committee remain anonymous except for the chairman, Dr. Norman E. Borlaug.

Winrock International can provide additional information about requirements for nomination. Please direct inquiries to Mr. Edward L. Williams, Administrator, General Foods World Food Prize, Winrock International, Petit Jean Mountain, Morrilton, Arkansas 72110, USA; telephone 501-727-5435; telex: 910-720-6616 WI HQ UD; Dialcom 41:TCN400. ■



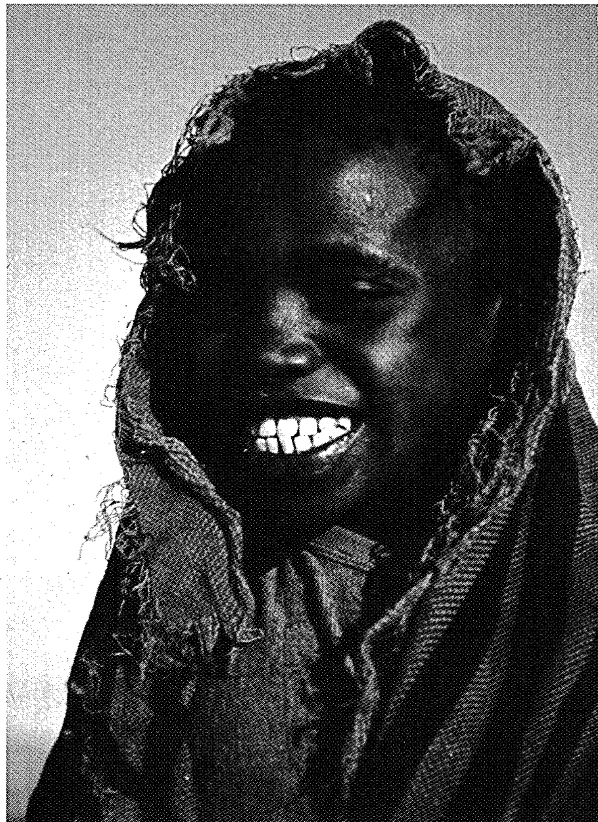
# INTERNATIONAL AGRICULTURE

UNIVERSITY OF ILLINOIS  
AT URBANA-CHAMPAIGN

COLLEGE OF AGRICULTURE

1988 Vol. 3, No. 3

Update



Photograph by Michael E. Irwin

The people of the United States showed a generosity of spirit and the best face of human nature when they responded to the tragic famine in Africa a few years ago. Those efforts saved millions of lives. However, they were only a stop-gap measure. The challenge confronting us now is to address the underlying causes of famine.

## Focus on Africa

In spite of the success of the Green Revolution in Asia, hunger, recurrent famine, and unremitting malnutrition remain as widespread and dangerous as ever in Africa. Africa's continuing crisis presents a challenge that the world cannot afford to ignore.

This issue of the *International Agriculture Update* is one of two focusing on Africa. We are pleased to present herein articles on U.S. policy and actions concerning Africa by guest authors Nyle C. Brady, senior assistant administrator, Bureau for Science and Technology, U.S. Agency for International Development; Charles L. Gladson, assistant administrator, Bureau for Africa, U.S. Agency for International Development; and Paul Simon, senator from Illinois and chairman of the Subcommittee on Africa, U.S. Senate Foreign Relations Committee. The next issue of the *International Agriculture Update* will highlight how programs and projects in which UIUC is involved are helping to solve the challenge of hunger in Africa. ■

John J. Nicholaides III  
Director, Associate Dean, and  
Assistant Vice-Chancellor for Research

## The Challenge of Africa

Charles L. Gladson

Once again, reports of famine devastating Angola, Ethiopia, and Mozambique are focusing worldwide attention on Africa's precarious plight. The pictures of desert-dry and barren farmlands and of emaciated bodies crowded into emergency feeding centers are painfully familiar. The majority of Africans are worse off today than their parents were twenty years ago. It is important to recognize that the present problems in Africa have been years in the making.

**Historical perspective.** Since independence, African countries have pursued several paths for economic and social development with varying degrees of success. On the assumption that the fastest way to achieve economic and social growth was through massive state intervention, many countries have concentrated economic control in the central government. Their trade and foreign exchange policies have often discouraged exports and promoted inefficient domestic production of items that were traditionally imported. Their central governments have become the main sources of employment for the educated, sheltered farmers by controlling agricultural markets, protected consumers by

taxing the farmers, generated tax revenues by controlling international trade, and even entered into production to protect the economy from monopolies.

As long as the international economy was growing rapidly, these weak economic policies were hidden from view. Even when the world economy began changing after the dramatic increase in oil prices in 1973, recycled money from the sale of oil kept the cost of borrowing low and the demand for commodities high. African governments, by and large, avoided having to adjust to the new economic situation.

Problems became apparent when the second round of increases in the price of oil in the late 1970s precipitated a worldwide recession. On the financial front, disaster struck when tax revenues and commodity prices dropped and government expenditures, particularly for debt servicing, rose. These fiscal imbalances resulted in inflation and increasingly overvalued currencies, which, in turn, led to a decline in exports and to the balance of payment problems that persist today.

**Response to the African crisis.** In the last several years, new developments give some cause for hope. The most important development is the commitment by African governments to a long-term program of economic reform, which was announced at the United Nations Special Session on the Critical Economic Situation in Africa in 1986.

**Reform necessary.** Many African countries are now involved in far-reaching economic reforms. As many as twenty-eight countries reported in 1987 having embarked on programs to institute policy reforms and restructure their economic systems. Most programs focus on revitalizing the agricultural sector, which employs 70 percent of the region's population, accounts for 40 percent of

gross domestic product, and produces 70 percent of all African exports. In many countries, investment in agriculture is reaching the target set by the United Nations of 20 to 25 percent of public investment.

More than thirty African countries liberalized their agricultural markets and dramatically increased the incentives for agricultural producers by allowing private traders to compete with the usually inefficient government marketing monopolies. Nine countries have markedly reduced their fiscal deficit as a percentage of gross domestic product; twenty countries have frozen public-sector hiring or reduced public-sector employment; and many have privatized, eliminated, or reduced subsidies to public corporations and organizations. There has also been significant progress in reducing biases that favored urban consumers and inefficient local production.

These reforms and improved climatic conditions resulted in some dramatic increases in production. For example, cocoa production in Ghana increased 45 percent between 1984 and 1987, peanut production in Gambia increased by 60 percent in two years, and the amount of locally grown food that was sent to market in Somalia increased by 50 percent between 1981 and 1985. Some African countries are close to achieving self-reliance in food production.

**Aid still needed.** For the continent as a whole, however, food shortages persist. Ethiopia, Mozambique, and other countries suffering from drought or civil strife require increased food aid in 1988.

The response from donors has grown slowly. Donor assistance amounted to US\$18 billion in 1986, a slight decrease in real terms from the US\$16 billion given in 1985. By 1987, however, the situation began to improve. The most important

development was an increase of US\$8 billion in the Structural Adjustment Facility of the International Monetary Fund (IMF). Many of the new resources are going to Africa to replace some hard-currency loans owed to the IMF with new, concessionary loans.

Other donors have responded generously to the crisis. Japan is committed to a US\$500 million aid package over the next three years. The European Community, Canada, Germany, Italy, and the Scandinavian countries are all increasing their aid to Africa, and a number of donors have nullified unpaid loans for development.

**The U.S. program.** The United States responded to the crisis in Africa with two important actions. First, a White House Task Force was formed in 1986 to review U.S. policies and programs in sub-Saharan Africa. As a result of this Task Force, President Reagan issued an End Hunger Initiative in March 1987, which called for a long-term U.S. commitment to attack the causes of hunger in Africa through the promotion of economic growth, policy reform, and private-sector development. The initiative has the following elements:

- A commitment to focus U.S. assistance on increasing the role of competitive private enterprise in African economic growth and development.
- Increased collaboration among donors.
- Increased reliance on U.S. private firms and private voluntary organizations in implementing U.S. programs in Africa.
- Improvement of the impact of food aid on development.
- Establishment of the Development Fund for Africa, commonly called the Africa Fund.

## DEPARTMENT OF EDUCATION AND EXTENSION



Photograph by John J. Nicholas III

UIUC and Egerton University, Njoro, Kenya, are participating in a USAID-sponsored project called IDAT. Through institution-building projects such as this, USAID and U.S. universities are helping to strengthen African agricultural universities of higher education. The availability of appropriately trained personnel is critical for agricultural and economic development.

The approval by Congress of the Africa Fund in fiscal year 1988 constitutes the second important action taken by the United States to respond to the crisis in Africa. The Africa Fund gives the U.S. Agency for International Development (USAID) greater flexibility in tailoring its programs to meet the special development needs of each African country. The U.S. budget crisis has precluded any major increases in aid to Africa. The Congress and the Executive Branch, however, have cooperated in protecting funds for Africa from the worst effects of recent budget cuts and, in fact, provided a modest increase in funding in fiscal year 1988.

The short-term to medium-term objective of the U.S. assistance program is to help Africans restart economic growth. Over the long term, we would like to see Africans participating in their own economic development and sustaining this growth.

The centerpiece of our short-term to medium-term effort is policy reform. With personnel in more than thirty countries in sub-Saharan Africa, USAID is uniquely placed for involvement in policy

reform. With few exceptions, we intend to work on sectoral policy issues. Work on macroeconomic issues is best left to the highly specialized staff and substantial resources of the IMF and the World Bank. USAID's focus is on helping Africans liberalize the agricultural sector, although we are also active in the transport, finance, public administration, and health sectors.

Liberalization is only part of our agricultural portfolio. We are furthering the development of agribusiness and the infrastructure of African transportation systems. We are helping Africans improve their agricultural research institutions because the availability of improved technology for African conditions is key to increasing agricultural productivity. We are contributing to the strengthening of African agricultural institutions of higher education because the availability of appropriately trained personnel for private and essential public-sector institutions is critical for economic development. We are helping them maintain the natural resource base because the contribution of their agricultural sectors to economic

growth heavily depends upon the sustained productivity of their natural resources.

USAID is also actively seeking ways to involve the private sector in nonagricultural areas. Fundamental to a growing private sector are functioning financial markets and the availability of foreign exchange for importing capital goods and raw materials essential to renewed economic growth.

To be successful, U.S. programs must be sustainable over the long term. Sustainable programs require investments in the development of human resources. They also require the development of more effective institutions. In institution building, the U.S. objective is to improve the effectiveness of government by reducing the government's role to policy analysis and other areas in which the government can and should perform effectively. Sustainable programs mean greater involvement of the private sector, both profit-making and nonprofit, in many of the economic and social sectors that had been dominated by the government. Finally, U.S.-sponsored programs for family planning, health care, and the survival of children will be maintained through greater use of U.S. private voluntary organizations, which have a long history of providing effective assistance at the grassroots level.

### **How the United States benefits from foreign aid.**

Contrary to assertions made by some critics of foreign aid, studies show that the United States is a major beneficiary of development assistance programs.

- Increasing per capita incomes of people in developing countries — a major goal of U.S. assistance — increases the demand for agricultural imports. A recent study by the U.S. Department of Agriculture found that a 10 percent increase in per capita income of developing

countries led to a 13.6 percent rise in U.S. exports to those countries.

- Similarly, a study conducted by the International Food Policy Research Institute showed that between 1961 and 1976, the sixteen developing countries with the fastest growing food-production sectors expanded their net food imports by more than 7 percent annually.
- Seventy percent of the money appropriated for direct or bilateral U.S. assistance is spent in the United States, not overseas. U.S. foreign assistance directly generated almost US\$7.0 billion in purchases of U.S. goods and services in 1985.
- Past recipients of U.S. food aid are now among the top buyers of U.S. agricultural exports. In 1986, seven out of the ten leading importers of U.S. farm products were former recipients of P.L. 480 assistance.
- Agricultural research conducted overseas benefits U.S. farmers. For example, the genetic sources of resistance to wheat rust come from Kenya. Information from research sponsored by USAID is credited with enabling scientists to contain the spread of peanut stripe virus in the United States. If the virus had spread, it could have severely affected income from peanut production.
- National security is enhanced by promoting economic growth and political stability in developing countries.

Africa is huge and diverse, and its problems are complex. Many African governments are now committed to taking the difficult steps necessary to improve their economic performance.

Our experience in Africa has shown that there are no quick-and-easy answers to the region's economic problems. While helping with short-term programs, we have also made a long-term

commitment to help Africans attack the causes of these problems. The wide range of expertise available in U.S. universities, private voluntary organizations, and the private sector is invaluable to our efforts to meet the challenge of African development. ■

*Charles L. Gladson is assistant administrator, Bureau for Africa, United States Agency for International Development. Former positions with USAID include director of the mission in Thailand, director of the mission in Kenya, deputy assistant administrator of the Bureau of Food for Peace and Voluntary Assistance, and senior deputy assistant administrator of the Bureau for Private Enterprise.*

## New Publication Available

**T**he *Agricultural Technology System of Taiwan* by Eldon L. Johnson, Frederick C. Fliegel, John L. Woods, and Mel C. Chu is one of a series of comparative case studies performed as part of the Technology Development and Transfer Systems in Agriculture project of the International Program for Agricultural Knowledge Systems (INTERPAKS). Published in December 1987, the study examines policy and planning, technology development, technology transfer, and technology utilization.

Single copies are available from INTERPAKS, 113 Mumford Hall, 1301 West Gregory Drive, Urbana, Illinois 61801, USA. ■

## African Agriculture and U.S. Foreign Aid

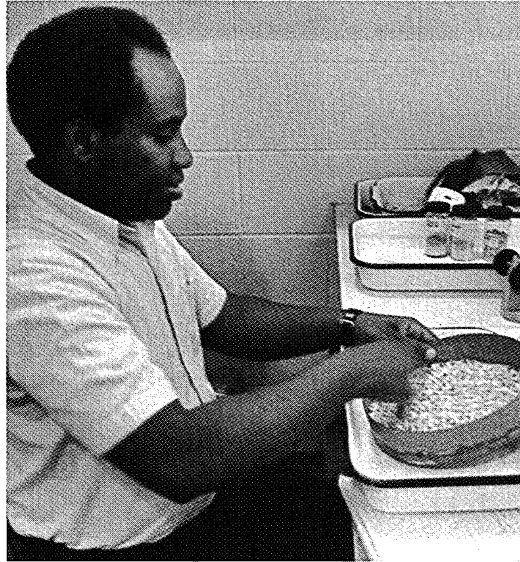
Paul Simon

**I**n the 1960s, President John F. Kennedy dreamed of eliminating hunger from the world by the end of the decade. Today, nearly thirty years later, millions of people in the world face starvation and malnutrition. Among those most seriously affected are the people of sub-Saharan Africa.

During the last two decades, Africa has been in a state of steep and steady economic decline. According to the World Bank, per capita income is 4 percent below the level prevailing in 1970. Public debt, which was an aggregate of US\$5 billion for the region in 1970, has soared to US\$65 billion today. Misguided governmental policies, civil war, drought and other natural disasters, and declining terms of trade for agricultural commodities in the world market have all contributed to a dramatic decrease in agricultural production in Africa.

In the twenty-four African countries most severely affected by drought and famine in 1984 and 1985, per capita cereal production decreased by an average of 2 percent a year over the last fifteen years. While food production declined, the population in this region continued to grow at one of the highest rates in the world, 3 percent annually. Today, 100 million Africans, one out of every four, suffer from malnutrition or severe undernourishment. If present trends continue, the projected food deficit for Africa by the year 2000 will be ten times the famine-level shortfall of 1985.

After completing advanced-degree work at UIUC through the ZAMARE project, Dr. Sakufiwa has returned to his research responsibilities in Zambia's Ministry of Agriculture and Water Development. Throughout Africa, trained agriculturalists are woefully lacking. Although great strides have been made in the last decade, illiteracy is commonplace. One of the reasons UIUC has made training a cornerstone of its international development activities is that education has a vital role to play in supporting self-reliance in food for developing countries.



Photograph by David A. Reeds

**Agriculture is the base.** The tragedy in Ethiopia, Mozambique, and other famine-ridden countries has demonstrated the urgent need to revitalize agricultural production in sub-Saharan Africa. A thriving agricultural sector is essential for the development of African economies. Agriculture must serve as the base for all forms of economic progress in the majority of African countries. African leaders, themselves, have recognized this fact.

At the 1986 United Nations Special Session on the Critical Economic Situation in Africa, African nations agreed to a program for economic recovery and development that placed the highest priority on agricultural development. Originally formulated by the Organization of African Unity, this program is designed to increase African self-sufficiency over the next five years, particularly in agriculture, and is oriented toward self-help. It reflects the determination of African nations to take responsibility for their own problems. In return, the international community pledged to support the Africans' efforts through increased and more effective assistance.

**Misguided efforts.** For too many years, the United States and other donors in the international

community have funded programs and projects in Africa without fully understanding the needs of the African nations and the African people. Some of the problems are unique to this continent and there are differences among individual African countries. Regional solutions that worked in other areas of the world are simply not relevant to Africa. Money has poured into Africa, but little progress has been made in development. Today, the international community and Africans themselves believe that the key to successful development is greater African involvement in the process.

**U.S. role.** If the United States is to contribute to successful development in Africa, then its foreign aid program should involve Africans from the grassroots to the national level. The Africa Famine Recovery and Development Act, which I introduced in March 1987, emphasizes equitable, environmentally sound programs that stress self-reliance and African participation. In an effort to ensure African input into the development of U.S. aid programs, the bill directs the United States Agency for International Development (USAID) to consult with cooperatives, trade unions, women's groups, and other indigenous organizations as well as with

U.S. private voluntary organizations working in Africa.

Recent studies by the World Bank and the Office of Technology Assessment (OTA) suggest that the most effective way to improve agricultural production in Africa is to increase the output of small-scale, subsistence-level farmers and to provide technology specifically suited to African agricultural methods. The bill I introduced identifies agricultural production as a critical sector for development. It emphasizes efforts to assist small-scale farmers and to provide agricultural research and education that are specifically designed for the African context. African farmers need what OTA calls "low risk, low input" technology, such as seeds and fertilizers, suitable to their methods of farming and the size of their farms. In addition, extension programs and other educational activities should provide training to improve, but not supplant existing agricultural techniques in Africa. Agricultural production is crucial for development.

**Role of women.** African women play a critical role in the agricultural sector, producing anywhere from 60 to 90 percent of the food in most countries. In addition, they are primarily responsible for marketing the food at the local level. In recognition of the fact that women are the primary producers in Africa, the bill provides for expanded developmental activities for women to enable them to increase their productivity.

**Government policy.** One obstacle to increased agricultural production in Africa is misguided governmental policies, often in the form of subsidies for city dwellers. In recent years, African leaders have realized the need to reform agricultural policies to provide incentives to the local farmers. Countries, such as Zambia and Mali, for example, have engaged in these often politically difficult reforms with considerable success.

In Zambia, maize production of small-scale farmers has increased three-fold, from 20 to 60 percent of total production. This increase reflects, in part, the success of the Zambia Agricultural Research and Extension (ZAMARE) project. A USAID-funded project of the University of Illinois at Urbana-Champaign (UIUC) in collaboration with Southern Illinois University at Carbondale and the University of Maryland-Eastern Shore, ZAMARE assists the government of Zambia in its efforts to improve the welfare of small-scale farmers and increase national food production. Since ZAMARE's inception in 1982, two high-yielding varieties of maize that are open pollinated and seven hybrid varieties of maize have been developed and released. Improved technology for other crops was also developed and released by the ZAMARE project. Increased production resulted from the application of appropriate agricultural technology coupled with price reforms.

USAID listed the ZAMARE project in the FY87 and FY89 Congressional Presentations as an African success story. USAID decided to discontinue ZAMARE after Phase I because it felt that enough new technology in small-scale food production had been developed to get things moving in the right direction, and because it felt that the World Bank and the African Development Bank would have similar projects under way to meet additional needs and diversify production. An effective assistance strategy for Africa should include support for projects such as ZAMARE and sectoral policy reforms.

### **The challenge continues.**

The people of the United States showed a generosity of spirit and the best face of human nature when they responded to the tragic famine in Africa a few years ago. Those efforts saved millions of

lives. However, they were only a stopgap measure. The challenge confronting us now is to address the underlying causes of famine in an effective and cost-efficient manner. I believe the approach outlined above can help us to do that. The African nations have made a commitment to reverse the economic decline of their continent. We have an opportunity, as well as an obligation, to support their efforts. ■

*Paul Simon, senator from Illinois, is chairman of the Subcommittee on Africa, United States Senate Foreign Relations Committee.*

## **Creating and Sustaining a Green Revolution in Africa**

**Nyle C. Brady**

**T**he world's farmers produce enough to feed every man, woman, and child on earth. But in many developing countries, harsh and unproductive agricultural conditions and the lack of purchasing power prevent millions of people from getting enough food. They cannot grow it, and they have too little money to buy it. Twenty-five years ago a similar situation existed: the difference between then and now is that the continent suffering from the most serious food deficiencies has shifted from Asia to Africa.

**Green Revolution.** Even though the population of Asia has nearly doubled since the early 1960s, a revolution in the agricultural process — now known as the Green Revolution — enabled Asian farmers to maintain and even slightly increase their per-capita production of food. Factors

that contributed to the Green Revolution in Asia included superior varieties of rice and wheat, improved application of water and fertilizer, and government policies that encouraged increases in production. Hardier crops, larger and more predictable yields, and invigorated research and educational systems stimulated agricultural growth and, in turn, increased family income and general economic well-being.

An equally spectacular change must now occur in Africa, particularly in the Sahel region south of the Sahara, where the most severe food deficits exist. The continent's once-balanced agricultural system has failed; per-capita food production has actually declined during the last two decades.

### **Constraints to development.**

Although many factors contributed to Africa's declining food production, five are most conspicuous.

- The growth of Africa's population is the fastest in the world. In many countries, the population is doubling every 18 to 25 years, placing an intolerable burden on individuals, families, communities, governments, and, above all, on the region's resources.
- Africa's natural resource base limits food production. The continent's soils tend to be less fertile and more prone to erosion than those in Asia. In addition, meager water resources are a serious constraint. Next to Australia, Africa is the world's driest continent. There are few sources of water to irrigate even semi-arid areas.
- Government policies generally discourage, rather than stimulate, agricultural production. Price structures discriminate against farmers and rural people in comparison to city dwellers. These policies reduce farm income and restrict the purchase of seeds and chemicals that improve yields.



Photograph by Deirdre M. Birmingham

Women applying composted manure to potatoes in Kenya. Although the Green Revolution has raised hopes about the power of technology to solve our agricultural problems, what is needed in Africa are low-input, low-cost solutions that incorporate, rather than abandon, local subsistence practices and resources.

- Technology to address the many production and marketing problems in Africa is limited. Animal diseases restrict cattle production to an area one-third the size of the United States. This restriction prohibits the use of animals for draft purposes and forces farmers to use hand tillage and cultivation. Improved crop varieties, like the ones that fueled the Green Revolution in Asia, are rare. Proven cropping systems to replace the destructive slash-and-burn system are needed.

- Trained agriculturalists are woefully lacking. Although great strides have been made in the past decade, illiteracy is commonplace. Technicians to operate and maintain mechanical equipment are not generally available, and university-trained scientists and educators are also scarce.

By overcoming similar constraints to development, the Asians increased their production of wheat, rice, maize, and other cereal crops. Increased production raised rural incomes and stimulated purchases of food and other commodities. The energized marketing system increased imports of agricultural and consumer products and stimulated

domestic production. This sequence of events illustrates the fact that developing countries with fast growth rates in the production of staple foods have steadily increased their imports of agricultural products.

**Focus on Africa.** The events of the past 25 years give us the pattern for the future. We will continue to cooperate with Asia and Latin America. Now, however, we must give greater attention to Africa, where the Green Revolution has been stymied. Sustainable improvements in African agriculture will require unprecedented scientific accomplishments.

A wide variety of new and improved techniques for family planning must be developed and made available to help ease the economic and social pressures created by very rapid population growth. These efforts should include further biomedical research on inexpensive, easy-to-use contraceptives, and social research to determine culturally acceptable modes for bringing family planning information and services to the attention of families who seek such information and services.

Agricultural technology and cropping systems that are inexpensive and involve low risk must be designed so that farmers can produce more food despite the limitations of soil and water resources. At the same time, these innovations should protect and, where possible, improve the fragile natural environment.

Scientists must creatively use both new and proven technology as they respond to the challenge of these and other problems:

- Biological control of mealy bugs and green spider mites — both major insect pests on cassava — will help increase production of this indigenous African crop without polluting the scarce supplies of water.

- Leguminous trees that biologically fix nitrogen can be planted in or around cultivated fields to help prevent soil erosion, improve the soil by providing an essential plant nutrient, and keep soil arable year after year. Farmers would not feel the need to cut down forested areas to replace croplands they have cultivated for a few years. Multipurpose trees preserve the rapidly disappearing forests.

- Manure and inexpensive mulches of cuttings from leguminous trees can help small-scale farmers reduce soil erosion and increase soil nutrients and efficient use of water.

- Farm animals need to be protected from widespread and damaging diseases, some of which are unique to Africa. In particular, African farmers need a vaccine or other reliable control agent against animal trypanosomiasis — a disease that prevents the herding of cattle in large sections of central Africa. Not only do these diseases reduce available meat and milk, they also eliminate the one source of readily-available, on-farm power, severely curtailing productivity of labor.

### **Preserve the environment.**

As technology is developed and harnessed for use in Africa, preference must be given to technology that protects the natural environment. In fragile regions, agriculture can become a battle ground between ecology and technology. Costs and benefits of new production technology must be fully assessed in terms of impact on natural resources.

**Role of education.** During these critical developmental years, African nations must continue to receive food aid and other forms of emergency assistance when necessary. They also must have help in developing the critical mass of trained personnel and in-house expertise that will equip them for continuing the creative process far into the future.

U.S. agricultural institutions of higher learning were instrumental in helping India and other Asian countries strengthen their research and training capacities. Today, through even stronger ties with the U.S. university community, the United States Agency for International Development (USAID) is helping to strengthen graduate and postgraduate institutions in Africa.

One such long-term effort began during the 1960s at Egerton University in Kenya. With USAID assistance, Egerton has expanded and improved its teaching staff and physical facilities. Through a new project with the University of Illinois at Urbana-Champaign (UIUC), technical assistance is focused on improving curricula and teaching materials, strengthening faculty, and upgrading administrative capabilities. The goal is to help create a strong national university that will provide first-rate agricultural training to Kenyans and students from other African countries.

An agricultural research and extension project in Zambia is a good example of a recent success.

Since 1982, teams of researchers from UIUC, Southern Illinois University at Carbondale, and the University of Maryland-Eastern Shore have been collaborating with Zambia's Ministry of Agriculture and Water Development (MAWD) to increase food production and improve the lot of small-scale farmers in Zambia. The collaboration produced a number of breakthroughs, including improved cultivars of maize and sunflowers. As a result, production of these crops has increased dramatically. The research collaborators gave special attention to the needs of Zambian farmers, and new technology was tested on their fields. At the same time, the research and extension skills of MAWD staff members were enhanced through advanced academic and technical training. Zambia's private sector became involved, particularly in seed production.

Similar institution building endeavors are underway at Makerere University in Uganda, the University of Zimbabwe, and other institutions of higher education in Africa. In the Cameroon, a new university is being created.

**Future demands.** The demands on the ingenuity and time of researchers as they seek solutions to Africa's problems will be great. Even with biotechnology, computers, satellites, and other modern, time-saving innovations, a broad array of improvements cannot be expected to fully emerge for ten to twenty years. To succeed, family planning programs, resource conservation efforts, and widespread adoption of new technology must be supported by government policies that endorse such changes. Decision makers in African governments need to be informed and encouraged to make the difficult policy choices that will yield long-term benefits to their citizens.

In cooperation with USAID, our capable university community is

helping Africa move toward food security. Already, hardier crop varieties, improved crop management systems, and innovative irrigation and tillage methods are helping African farmers improve and sustain production. But only the surface has been scratched; Africa has a long way to go.

The expertise that has kept U.S. agricultural production in the forefront must now be more fully applied to the realities and constraints facing agricultural production in Africa so that the people of that continent can achieve food security, economic growth, and the wherewithal to determine their own destiny. ■

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# INTERNATIONAL AGRICULTURE

UNIVERSITY OF ILLINOIS  
AT URBANA-CHAMPAIGN

COLLEGE OF AGRICULTURE

Update

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Photograph by David A. Rieckes

Pineapple plantation? No, this is how some of the maize crop looked in central Illinois after the summer drought of 1988; yields were reduced by nearly 50 percent. An interdisciplinary FAO working group warns that global warming presents a clear and ominous danger to future food security. Agroecological zones could shift as much as 700 kilometers (434 miles), threatening major grain-producing areas around the world.

## Stewardship of Planet Earth

No issue probably draws more national and international attention than the environmental future of our planet and perhaps even of our species. For our readers' reflection, this and the next issue of the *International Agriculture Update* offer important perspectives on the judicious stewardship of our natural resources and environment.

We are pleased to present guest articles by James G. (Gus) Speth, president, and Irving M. Mintzer, senior associate, of the World Resources Institute (WRI). WRI is an independent research and policy institute founded in 1982 to help governments, environmental and

development organizations, and private businesses address the fundamental question of how societies can meet basic human needs and nurture economic growth without undermining the natural resource base and environmental integrity. We hope that the authors' insights will help you understand these complex issues clearly and determine some of the actions that must be taken by individuals and governments worldwide to address one of the most pressing concerns of our day. ■

*John J. Nicholaides III*  
Director, Associate Dean, and  
Assistant Vice-Chancellor for Research

## The Global Environmental Challenge

James Gustave Speth

The environmental concerns of the 1990s mark a departure from those of the past several decades. While we must continue vigorous local and national campaigns to clean up fouled waterways and rid the air of harmful pollutants, new challenges have emerged that call for concerted global action. The problems of global warming, acid rain, ozone depletion, tropical deforestation, and species loss are truly international in their effects and solutions. The world is also faced with a different range of environmental issues due to the massive poverty afflicting the majority of the earth's inhabitants.

Air pollutants, ozone depleters, and "greenhouse" gases travel freely across national boundaries, harming environments of many countries. On the global stage, nations no longer act in isolation. Coal-fired power plants in the United States and tropical deforestation in Brazil can have economic and environmental ramifications as far away as Europe and Southeast Asia.

Similarly, actions to forestall and reverse environmental degradation have spread from local and national governments to international summit meetings. In these arenas, the traditional topics of international trade, energy, and development can no longer be discussed without substantial reference to the earth's resources, systems, and cycles.

Mirroring the rapid growth of economic activity and of world population following World War II, the use of fossil fuels has steadily risen, along with emissions of oxides of sulfur and nitrogen and other pollutants. Acid rain and ground-level ozone are now harming soils, forests, aquatic life, and crops over large areas of the globe.

Carbon dioxide, another product of fossil fuel combustion and not a pollutant in the traditional sense, is the major culprit behind the threat of greenhouse warming. Previous emissions of carbon dioxide and other greenhouse gases, combined with rapid deforestation, have set the earth on a path toward climatic changes in the future. Exactly what changes will occur and how soon they will appear remains unclear, but much depends on how and when societies respond.

Chlorofluorocarbons (CFCs), which are highly stable industrial chemicals released from aerosol cans, refrigeration systems, and blown-foam materials, are speeding the destruction of the ozone layer in the upper atmosphere. Without this protective layer to screen the earth from the sun's harmful ultraviolet radiation, natural ecosystems will be disrupted and the incidence of human skin cancer, diseases of the immune system, and eye cataracts will increase.

These interrelated atmospheric issues constitute the most serious pollution threat in history. Simultaneous and gradual, their effects will be difficult to reverse. Because they are linked to the use of fossil fuels, energy policy and environmental policy must be made together in the future.

Of equal importance to atmospheric pollution is the steady deterioration of natural resources — forests, soils, and water — and living conditions of people in much of the developing world. Most people lack access to basic sanitary facilities; unsafe water causes 80 percent of all illnesses. The United Nations Food and Agriculture Organization predicts that without corrective action, soil erosion and nutrient depletion will lower agricultural productivity 30 percent on rainfed

croplands. In Africa, thirty trees are cut down for every one planted. Across the globe about 22 hectares (54 acres) of tropical forest disappear every minute along with uncounted plant and animal species.

Last year, the World Commission on Environment and Development stated, "Poverty is a major cause and effect of global environmental problems." Fighting poverty requires defusing the underlying pressures on the world's resource base. We must confront rapid population growth, shortsighted economic policies that encourage the wasteful use of resources, and misguided development programs that have neglected environmental factors and local needs.

A closer look at the many facets of today's global environment further reveals the intricate connections between humans and their environment. Societies have long molded their surroundings to suit their needs. Today, the environment is voicing its response. The challenge for world leaders is to promptly coordinate national efforts toward creating a healthy environment.



Photograph courtesy of UIUC College of Agriculture

The U.S. National Crop Loss Assessment Network estimates that ozone damage to maize, peanuts, soy, and wheat causes losses of US\$5 billion annually. Based on a mathematical equation developed from various studies, Illinois scientists calculate that the ozone concentration in Champaign County, Illinois, is reducing yields by 10 to 15 percent. This estimate does not include the effects of other major pollutants and the increased susceptibility of crops to insect damage, disease, and drought.

Recently, Margaret Thatcher, Mikhail Gorbachev, Rajiv Gandhi, George Bush, and other leaders have pointed to global protection of the environment as key to future progress on the planet. They and others can act on this conviction by declaring the 1990s as the International Environmental Decade. Concerted international action over the next ten years would be a gift of historic proportions to following generations.

**Slowing the greenhouse effect.** Droughts and heat waves in 1988 gave Americans a taste of what a global warming trend could mean. Climatic changes are likely because the increasing concentrations of carbon dioxide and other trace gases in the atmosphere trap the earth's infrared radiation, preventing it from escaping into space. The greenhouse gases are produced by burning coal, oil, and natural gas, by deforestation and certain agricultural activities, and by releasing various industrial chemicals.

The largest single contributor to the greenhouse effect is carbon dioxide, which is mainly created by the combustion of fossil fuel. Half of the carbon dioxide added to the atmosphere throughout human history has been added during the past thirty years. Other gases, including the CFCs that destroy the stratospheric ozone shield, also contribute to the greenhouse effect. Some CFCs absorb infrared radiation up to 10,000 times more efficiently (per molecule) than carbon dioxide does.

In the lower atmosphere, ozone, methane, and nitrous oxide trap heat and add to the greenhouse effect; each of these greenhouse gases can be linked to the use of fossil fuel. Methane and nitrous oxide are also released in agriculture and forestry.

The rapid pace with which these gases have accumulated in the atmosphere in recent decades raises serious questions about the future of the earth's climate. Even if all greenhouse gas emissions were stopped today, the planet could still warm by about 1° to 2° C (2° to 4° F), according to current estimates. If global greenhouse gas

emissions continue at today's rates, the average global temperature could rise by 1.5° to 4° C (3° to 8° F) by the time today's teenagers reach retirement age.

The greenhouse effect will not register in the same way everywhere. Temperature rises will be the greatest in the higher latitudes, and this uneven warming will influence the wind and ocean currents that determine climate. Some areas will have more rainfall, others less. If current predictions hold, important agricultural areas in the U.S. Midwest and Southeast could be hotter and drier during the growing season. The warming could be accompanied by an expansion in grasslands and deserts, forest fires, species losses, and a decline in forest ecosystems. Some irrigation and hydroelectric projects could no longer receive adequate rainfall while others might overflow.

Changes in the oceans can be expected too. Coastal development and wetlands would be threatened with a 0.3- to 1.2-meter (1- to 4-foot) rise in sea level by the middle of the next century. Storm damage to lagoons, estuaries, and coral reefs — not to mention buildings and other artificial structures — could also increase. By one recent estimate, erecting protective barriers and making other adaptations to rises in the sea level would cost a medium-sized city, such as Charleston, South Carolina, about US\$1.5 billion.

Although most buildup of greenhouse gas comes from combustion of fossil fuel, not all fuels contribute equally. Per unit of energy released, coal burning releases the most carbon dioxide; the same amount of energy from oil releases 30 percent less carbon dioxide; natural gas, half as much. Energy produced from nuclear or renewable sources (such as hydro power, wind, or solar technology) releases no carbon dioxide. Emissions would fall — even if energy use did not — if people would use energy technology that releases less carbon dioxide.

Meanwhile, the cutting and burning of tropical forests contributes about 20 percent of the carbon dioxide added to the atmosphere each year. Although these forests do far more in the



Photograph courtesy of UIUC College of Agriculture

More than 160 million tons of sediment are eroded from Illinois agricultural land every year and almost 2 billion tons of soil for the United States as a whole. In terms of farm production, that erosion translates into losses of US\$1 billion annually. Erosion is not just a farming problem. Once the soil leaves the land, it can affect the water supply and the condition of drainage ditches, lakes, reservoirs, and streams. On sloping land, contour strip cropping that alternates row crops with grass, forage crops, or small grains can help prevent erosion.

biosphere than store carbon, their role in regulating the greenhouse effect should not be overlooked.

The world's choice is not between preventing a temperature rise or adapting to climatic changes. A certain amount of warming now appears inevitable. But action taken today can stabilize future warming and allow societies more time to adapt to unavoidable changes. The political drawback is that the costs of preventing damage must be paid now even though future benefits are uncertain. If political choices are put off, however, more extreme measures will be needed in the future. Almost certainly, waiting is not the best policy.

**Protecting the earth's ozone shield.** Depending upon where it resides in the atmosphere, ozone can both harm and help. Near the earth's surface, ozone and other oxidants, sometimes called smog, take a toll on human health, damage trees, and reduce crop yields. Ozone also acts as a greenhouse gas. But in the stratosphere, some 25 to 40 kilometers (15 to 25 miles) above the earth, ozone filters harmful ultraviolet rays from the sun's

radiation. Weakening this protective shield invites more skin cancer and eye disease, reduces the response of the human immune system, and harms plant and animal life.

Fifteen years ago, scientists predicted that CFCs would rise into the stratosphere, and that through a complex chemical reaction, CFCs would destroy some of the ozone and allow more ultraviolet radiation to reach the earth's surface. Theory became fact when scientists discovered a large "hole" in the ozone layer over Antarctica in October 1985 and three years later confirmed that CFCs had caused it. In the northern hemisphere, a more widespread decrease in ozone levels of about 3 percent has been observed — a loss too large to attribute solely to nature.

In response to ozone depletion, governments around the globe, led by the United Nations Environment Programme, agreed in November 1987 to the Montreal Protocol, which would halve CFC use in industrial countries by 1999. Given the latest evidence of damage, however, the protocol is now widely viewed as insufficient to protect the ozone layer fully.

**Curbing acid rain and oxidants.** Damage to public health and forests, lifeless lakes, soured soils — these are signs that air pollutants are taking a toll. Gauging the effects of each pollutant has never been simple because air pollutants mix together, interact, and compound other environmental stresses. Yet the planet is feeling the impact of pollution. Between 1900 and 1985, the world's annual sulfur dioxide emissions increased sixfold and emissions of nitrogen grew ten times. These gases, together with the hydrocarbons that also result from fossil fuel combustion, are the principal sources of both urban air pollution and the acid rain and oxidants that now douse the North American countryside.

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**The United States has one of the world's least energy-efficient economies, burning twice as much energy for the same amount of economic output as either Japan or West Germany.**

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The damaging effects of acid rain on aquatic life in the United States, Canada, and Europe have been well documented over the last decade. Recent evidence from Central Europe and the United States points to corresponding damage to forests. Ozone and other oxidants have recently been implicated in declines of pines in southern California and the eastern United States. The case is also strong that sulfuric and nitric acids contribute to the decline of the high-elevation red spruce in the Appalachian Mountains from Vermont to North Carolina, Fraser fir species in the Southeast, and other stricken tree species in the East.

Crop productivity is also being impaired, with ozone losses among sensitive crops ranging between 5 and 20 percent. Overall agricultural crop

losses from air pollution have been estimated at up to US\$5 billion annually.

Acid deposition and oxidant levels are high where acid rain has damaged trees and crops. Along the Appalachian Mountain chain the acidity of cloud moisture is 10 times greater than that at lower elevations and about 100 times greater than that of unpolluted precipitation. The peak cloud acidity at several eastern mountains is comparable to that of lemon juice. Unless strong new measures are adopted, air pollution problems are going to worsen steadily in the coming decades, leading to further forest damage, crop losses, ill health, water and soil acidification, damage to materials, and losses in visibility.

**Conserving tropical forests and biological diversity.** The world's tropical forests are being destroyed so fast that unprecedented global action should be taken. When these forests are cut down, thousands of plants and animals are lost forever. The planet's greatest storehouse of biological diversity is its tropical forests; if current destruction continues, hundreds of thousands of species will become extinct by the year 2000.

Even though most tropical forests are in developing countries, the United States cannot afford to take the role of a disinterested observer. The genetic resources in these forests are important to U.S. agriculture. For example, plant breeders must periodically return to the wild source for disease-resistant or drought-resistant genes. The forests are also vital to medicine; one-fourth of all prescription drugs are derived originally from plants, and scientists have barely begun to analyze the millions of species found in tropical forests. In addition, industries use rubber and other extracts, resins, dyes, and other forest products.

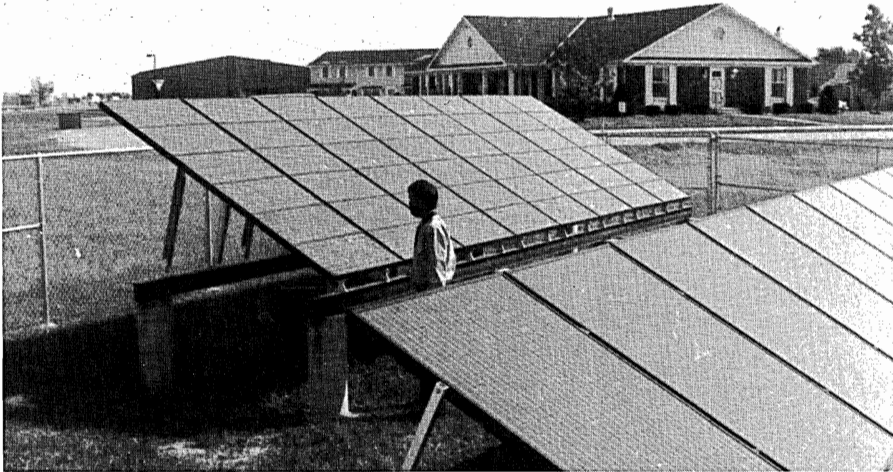
Lost genetic resources aside, forests cannot be razed without major environmental side effects. Once the forest cover is gone, nothing blunts the force of rainfall, allowing erosion to strip the soils and to carry sediments downstream. These sediments degrade

fisheries, silt up reservoirs, and clog irrigation systems.

The causes of deforestation are inseparable from the major problems of developing countries. Population pressures, poverty, and inequities in land tenure all lead to clearing new land. Pressure to generate foreign exchange for debt payments is seen as justification for mining the forests and converting forested land to cash crops and cattle ranches. In many cases, government subsidies stimulate forest destruction at public expense.

**Forging new energy strategies.** One key to solving these many interrelated challenges is energy policy. For example, the United States has one of the world's least energy-efficient economies, burning twice as much energy for the same amount of economic output as either Japan or West Germany. This excessive use of energy contributes to lowered foreign competitiveness in addition to increasing the risks of pollution and climatic change.

New energy strategies that simultaneously address energy supplies and environmental protection must be central to any government's long-range plans. Comprehensive energy strategies, which are as important for industrialized countries as for developing countries, should include two major components. First, nations should improve energy efficiency. All sectors of the economy would benefit from prototype automobiles that get 35 kilometers to the liter (100 miles to the gallon), miserly light bulbs, and innovative industrial processes that require only a fraction of the energy of former methods. Second, energy sources from nonfossil fuel should be vigorously developed and brought to market. Solar, hydro, wind, biomass, geothermal, and other renewable sources produce no net carbon dioxide or other pollutants. Promoting these objectives requires economically and environmentally realistic energy prices. Subsidies should be removed from power sources that pollute, and the true costs of pollution should be reflected in the price of fuels and related activities.



Photograph by Gene C. Shove

Ted L. Funk, county adviser, stands by a photovoltaic panel that heats the University of Illinois Cooperative Extension Service regional office in Effingham, Illinois. This system, which demonstrates residential-scale solar direct-energy conversion, is interconnected with the local public utility company. Solar energy provides an alternative to conventional energy sources that release carbon dioxide into the atmosphere.

**Halting environmental deterioration in developing countries.** Supported in part by international assistance, some Third World countries have experienced impressive economic growth and substantial gains in health, life expectancy, and education. Such efforts have also brought modest industrial and agricultural increases in many countries. Yet all around the world, poverty remains a crushing burden.

The worldwide recession and debt crisis of the 1980s have reversed economic growth in many countries and slowed it in others. Even though the birth and death rates have dropped in most countries, in absolute numbers their population continues to rise, putting heavy pressure on natural and financial resources.

Why have many poor countries failed to grow adequately? The reasons are numerous and include wide swings in world commodity prices, currency fluctuations, weak or corrupt institutions, inadequate training, mistaken government or donor policies, inequity, and political instability. Perhaps the least appreciated factor until recently has been the mismanagement of natural resources.

Developing countries are many times more dependent than industrial countries on their natural resource base — their soils, water, fisheries, forests, and minerals. Within these

countries, the poor are the most dependent of all. Yet this resource base is eroding rapidly and undermining their prospects for development.

Some development projects have had major costs. An often cited example is the construction of roads into the Amazon and the unsustainable agricultural settlement that followed. More common are the effects of heavy or otherwise inappropriate uses of fragile highlands, drylands, and forests — overgrazing, overcutting, and overfarming until the resource base has eroded away. Ultimately, such overuse contributes to famine (as in Ethiopia), to devastating floods (as in Bangladesh), and similar tragedies.

#### Promoting a sustainable future.

To promote progress in the 1990s, the United States and other industrialized nations must apply the lessons of the past decades. First, environmental damage bears high development costs. Second, development must be environmentally sustainable to be economically sustainable. Third, development strategies must emphasize natural resources. Resource sectors — agriculture, forests, fish and wildlife, minerals, and energy — provide more employment and export revenues than any other, and the natural limits of the resources must be respected in development plans if they are to be productive in the next century.

Sustainable development — development that maintains and enhances human, physical, and productive capacity without damaging the underlying resource base — is the key to any effective development strategy. Applying this approach requires both national governments and international agencies to evaluate the environmental consequences of development assistance programs and to support national development plans that conserve and restore the land's productive capacity. It means helping countries invest in reforestation, agroforestry, water conservation, and energy efficiency. It also means reducing debt and other pressures that force Third World countries to cash in their natural resources to earn foreign exchange. Family planning, health services, and better sanitation all deserve a high priority because they reduce child mortality and slow birth rates.

The 1990s will be the crucial decade for industrialized and developing countries to act on these pressing concerns. Nations North and South, East and West should respond promptly and in concert to sustain the earth and its inhabitants. ■

*James Gustave Speth has served as president of the World Resources Institute (WRI), Washington, D.C., since its establishment in 1982. From 1977 to 1981, Mr. Speth served first as a member and then as chairman of the Council on Environmental Quality in the Executive Office of the President. Before his appointment to the Council on Environmental Quality, he was senior attorney with the Natural Resources Defense Council.*

*The author would like to acknowledge the contributions of many members of the WRI staff in preparing this article. A fuller description of policy measures available to cope with global environmental challenges can be found in "The Crucial Decade: The 1990s and the Global Environmental Challenge," which is available from WRI.*

## Living in a Warmer World

Irving M. Mintzer

The summer of 1988 will long be remembered by U.S. farmers. Unexpected changes in air currents over the Midwest brought hot, dry weather that baked the region and withered crops. Other examples of "weird weather" were common elsewhere in the country. Abnormally high temperatures and low rainfall brought near-drought conditions to Wyoming, Idaho, Montana, and California. These unusually dry conditions set the stage for disastrous forest fires that destroyed large areas of parkland in all four states. In early September, the "storm of the century" swept across the Caribbean and slammed into south Texas and Mexico's Yucatan Peninsula. Residents of Washington, D.C., weathered a string of twenty-one days with temperatures over 32° C (90° F) that slowed the government bureaucracy to a crawl.

Similar events have recently struck with catastrophic results in other countries. In 1987, a heat wave killed 1,200 people in Greece. In 1988, heat waves and a late monsoon led to hundreds of deaths in India. Last spring, drought struck again in South and East China. In the Sudan, two years of drought ended in August when one year's worth of rainfall fell in three days, forcing 1.5 million people from their homes. In September, the worst flood of the century inundated Bangladesh, causing billions of dollars worth of damage.

No one really knows if these weather phenomena are merely anomalous blips on the geological weather line or if they are harbingers of future climate changes brought on by the "greenhouse effect." To find the answer to this problem, scientists recently have concentrated on discovering whether human-induced changes to the atmosphere could alter the global climate and increase the frequency of these natural disasters.

The earth's greenhouse. Scientists do know that burning fossil fuel, clearing and burning forest lands for agriculture, and certain other industrial and agricultural activities release gases that alter the heat balance in the atmosphere. The principal gases, sometimes referred to as "greenhouse" gases, include carbon dioxide, methane (swamp or natural gas), nitrous oxide (laughing gas), and the chlorofluorocarbons (refrigerants and propellants in aerosol cans, commonly called CFCs). All are transparent to incoming solar energy but absorb the infrared energy released by the earth's surface. These trace gases are present in the atmosphere in only minute quantities: less than 1 part per billion in air for the CFCs and a few hundred parts per million for carbon dioxide. Nonetheless, each molecule can trap substantial quantities of heat in the earth's lower atmosphere.

This heat-trapping effect has not always been a problem for the planet. In fact, the natural greenhouse effect, derived from background concentrations of carbon dioxide and water vapor, was essential to the evolution of life on the planet. In prehistoric times, these background concentrations warmed the earth's surface from about -18° C (0° F) to the preindustrial average of about 13° C (55° F). At this temperature, water exists as a liquid rather than as ice, creating conditions under which the rich biochemistry of modern life could develop.

Concentrations of carbon dioxide have varied greatly over the past millennia, but they have never reached the high levels that we measure today. The continuing buildup of greenhouse

gases is altering the composition and behavior of the atmosphere. A recent analysis of more than 120,000 temperature measurements indicates that the planet has already warmed by about 0.5° to 0.7° C (1° to 1.4° F) during the last hundred years. Computer models of emissions of greenhouse gas during this period, however, suggest that the full effect of past emissions has not yet been felt. The ocean, with its large thermal mass, acts like a flywheel in the planet's climatic system. The ocean's ability to absorb carbon dioxide and heat introduces a lag between the time that greenhouse gases are emitted and the date when the increased temperature can be measured. When the full effects of emissions prior to 1980 can be measured, perhaps by the year 2000, current computer models project that the earth's average temperature will have increased by 1° to 2.5° C (2° to 4.5° F) relative to the preindustrial era.

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Choices made today about energy policy, land use, and agriculture will affect the rate of future emissions of greenhouse gases.

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Charting the course of future warming. Warming due to these past emissions cannot now be avoided. Over a period of a few decades, this warming will change the planet's average temperature and alter regional climates at a pace not experienced for millennia. For comparison, a warming of just 2° C (4° F) will make the earth warmer than at any time since the beginning of recorded history. Of course, this does not mean that human beings cannot survive such a climatic change; it just means that we cannot look back and learn from historical records about the successful or unsuccessful adaptations of our ancestors.

Future warming will not be limited to the effects of past emissions. Choices made today about energy policy, land use, and agriculture will affect the rate of future emissions of greenhouse gases. These decisions in turn will determine the timing and severity of future global warming. Because we share our one atmosphere with neighbors the world around, not only choices made in the United States but also those made in Western Europe, Japan, the Soviet Union, China, and other countries will affect the rate of future warming.

If current trends in greenhouse gas emissions continue, the planet will warm by an additional 0.5° to 2° C (0.9° to 3.6° F) by 2030, relative to 1980. This increase represents a total warming of 1.5° to 4.5° C (3° to 9° F) above the preindustrial level.

The long-term effects of the greenhouse gas buildup will be complex and pervasive. With the melting of small, landed glaciers and the thermal expansion of ocean water, such a warming will cause global sea levels to rise by about 0.3 to 1.2 meters (1 to 4 feet). This rise will cause coastal inundation in low-lying areas as well as salt water intrusion into aquifers and river systems.

It will change the temperature gradient between the poles and the equator. The greenhouse warming at high latitudes is expected to be two to three times the global average, while the warming in the tropics will be only 50 to 75 percent of the global average. As a result of this shift in the earth's temperature gradient, the traditional regional patterns of winds, rains, and ocean currents will shift. Although total rainfall around the globe will increase slightly, the U.S. Midwest, the Soviet grain belt, the prime agricultural areas of China, and other midcontinent, midlatitude areas are likely to become hot and drier, especially in summer.

In addition, many scientists expect the frequency and severity of extreme weather events to increase. The fifty-year flood in many areas may become the twenty-year flood; the hundred-year storm may become the fifty-year

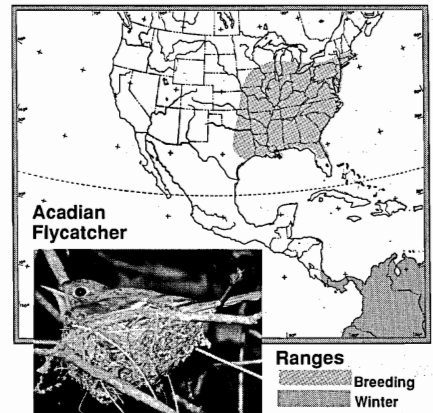
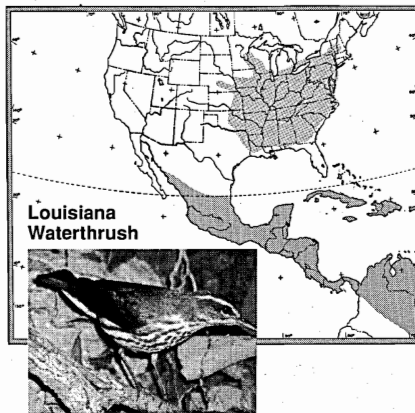
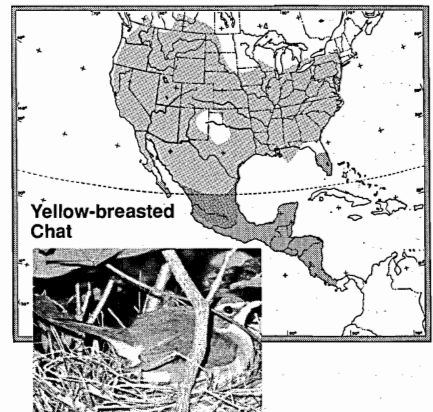
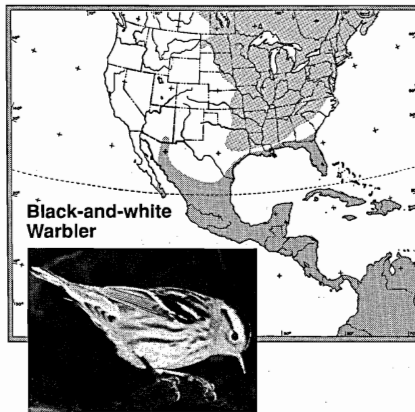
storm. The probability of long stretches of dry, hot weather and cold, wet weather is likely to increase. Although the unusual weather of the past two years is not necessarily due to the greenhouse problem, it is representative of the very kinds of events that are likely to occur with increasing frequency as the world warms.

**Adding fuel to the fire.** Unfortunately, the situation is likely to be substantially worse than this sketchy description suggests. At the same time that societies and ecosystems are struggling to adapt to the impacts of climatic change, other, equally difficult stresses must be confronted. The CFCs and methane that lead to global warming and climatic change also increase the risk of stratospheric ozone depletion. The activities that produce

greenhouse gases also emit the pollutants that lead to ground-level air pollution and acid deposition.

The problems of global climate change, ozone depletion, and ground-level air pollution are linked at several levels. These problems are linked economically because the same economically important activities generate the pollutants that cause all three problems. They are linked chemically because the pollutants interact in the atmosphere, often in complicated and synergistic ways. Finally, they are linked at the policy level because policy choices made to reduce or mitigate any one of these problems will unavoidably affect the other two.

The damage from stratospheric ozone depletion will be largely due to the resulting increase in harmful ultraviolet radiation. Exposure to this



Nearly three-quarters of the birds found in Illinois woodlands in the summer migrate to South and Central America in the winter. Their existence is threatened by the destruction of forests in the United States and rainforests in Central and South America. Recent census data of prairie birds show a steep decline in numbers. Although less information is available about woodland birds that migrate to the tropics, Illinois state ornithologists suspect that bird populations have already declined by 70 to 80 percent.

Photographs courtesy of the Illinois Natural History Survey  
 Maps adapted from material provided by the Illinois Natural History Survey

radiation will damage human health and reduce the productivity of forests, fisheries, and agricultural areas. The most important human health effects will likely include increased frequency of skin cancer, eye cataracts, and disorders of the immune system.

The impacts of ground-level air pollution and acid deposition will include reduced forest and crop yields, damage to streams and lakes, and rapid degradation of polymeric materials. In addition, the buildup of oxidants and particulates is likely to increase the damage to human respiratory systems.

**Responding to the threat.** The global climate is changing. Past and present emissions assure that it will continue to change. At a 1985 meeting on future climate change jointly sponsored by the United Nations Environment Programme, the World Meteorological Organization, and the International Council of Scientific Unions, 80 scientists from 29 countries issued an unusual warning:

Many important economic and social decisions ... assume that past climate is a reliable guide to the future. This is no longer a good assumption.

The challenge is to choose strategies that can slow the rate of change in the climate while preserving the prospects for economic growth. Slowing the rate of climatic change will buy time — time desperately needed to adapt to those climatic changes that can no longer be avoided. If this opportunity to develop resilient and robust responses is exploited, the disruption and dislocation caused by future climatic changes can be minimized.

From the standpoint of public policy, there are four essential elements to any successful national strategy to reduce the risks of rapid global climatic change. The first, and most important, element is to increase the efficiency of energy use, squeezing the most useful work out of every lump of coal or barrel of oil we burn. Second, we must reduce the biotic

contribution to greenhouse gas emissions by slowing the rate of tropical deforestation. Third, the use of the most dangerous chlorofluorocarbons must be eliminated. And fourth, especially in industrial countries, we must shift the mix of fuels from coal and other carbon-intensive fuels to natural gas and other less carbon-intensive fuels.

**The energy connection.** Ultimately, of course, we must build our energy economy on fuels that release little or no net carbon dioxide into the atmosphere. The most environmentally attractive sources include solar, hydroelectric, and wind power. Nuclear power does not emit carbon dioxide; but due to the high cost, long construction time, strong public opposition, and hazards associated with nuclear waste, it is unlikely that the nuclear option will reduce future emissions by a margin anywhere near the energy savings from improved efficiency.

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**Reducing the risks to an acceptable level on a global scale will require international cooperation and technology transfer on an unprecedented scale.**

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In developing countries, where 80 percent of the energy is derived from fuelwood, biomass can be exploited to combat greenhouse warming even though carbon dioxide is released in the process. Trees grown on woodlots or among crops and used for heating and cooking release no net carbon dioxide because the gas emitted during combustion is the same that was sequestered during growth. Managed fuelwood supplies also relieve pressure on natural forests and, when planted in conjunction with crops, boost farm yields.

By aggressively pursuing energy efficiency, limiting tropical deforestation, eliminating the most dangerous CFCs, and shifting back in the United States toward increased use of natural gas and renewable fuels, we can buy time for ourselves and our neighbors around the globe. As the world warms during the coming decades, we can develop adaptive responses to the unavoidable aspects of global warming. Reducing the risks to an acceptable level on a global scale will require international cooperation and technology transfer on an unprecedented scale.

For better or worse, we have only one atmosphere. To preserve its integrity for our grandchildren will require a new way of thinking by politicians, scientists, and people around the globe in all walks of life. Time is running short, but to a large extent, our fate is in our own hands. ■

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# INTERNATIONAL AGRICULTURE

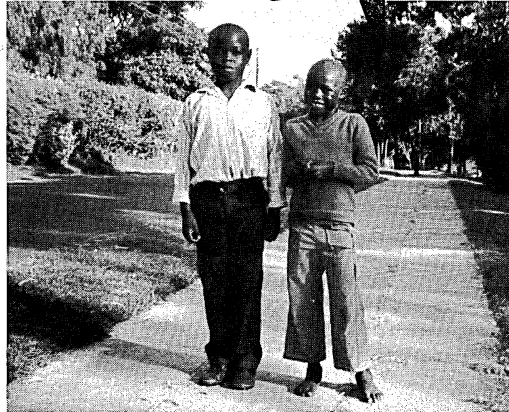
UNIVERSITY OF ILLINOIS  
AT URBANA-CHAMPAIGN

COLLEGE OF AGRICULTURE

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Update

Two children on the grounds of Egerton University, Njoro, Kenya. One way U.S. universities can contribute to sustainable agricultural development is by helping to educate a cadre of agriculturalists and environmentalists who can work toward this goal. Egerton University and the University of Illinois at Urbana-Champaign are participating in a long-term, collaborative, institution-building project to help strengthen and expand Egerton University into a pre-eminent center for agricultural training, adaptive research, and educational outreach.



Photograph by John J. Nicholaides III

## Sustainable Agricultural Production

E. T. York Jr.

"The next few decades present a greater challenge to the world's food systems than they may ever face again. The effort needed to increase production in pace with unprecedented increase in demand, while retaining the essential ecological integrity of food systems, is colossal, both in its magnitude and complexity. Given the obstacles to be overcome, most of them man-made, it can fail more easily than it can succeed."

This statement, by a special panel of the World Commission on Environment and Development, presents a sobering but realistic appraisal of the challenge facing global food systems. The last few decades have seen remarkable improvements in agricultural productivity throughout every region of the world except Africa. In fact, from 1950 to 1984, global cereal production increased 2.6 times, from 625 million tons to 1,645 million tons. Despite significant population growth during that period, per capita production of cereal increased some 40 percent.

The "Green Revolution," which resulted from major improvements in cultivars and production practices of cereal crops, enabled Mexico to increase its wheat production fourfold in the period from 1950 to 1984. Indonesia doubled its production of rice during the same period, and India tripled its wheat production in the years between 1965 and 1987. China, as a result of significant economic and

## Sustainable Agriculture and the Environment

The three articles we are privileged to present in this issue of the *International Agriculture Update* explore the relationship between poverty and environmental degradation and discuss the roles that donor agencies, international banks, international agricultural research centers, and others can play in helping to feed the world through sustainable agricultural programs. We are honored to have as our guest authors Robert O. Blake, chairman of the Committee on Agricultural Sustainability for Developing Countries; William R. Furtick, agency director for food and agriculture, United States Agency for International Development; and E. T. York Jr., distinguished service professor, University of Florida, Gainesville. This issue of the newsletter is the second of three that we are devoting to the environment.

On October 16, countries around the world will commemorate World Food Day. The theme in 1989 is food, development, and environment — a sustainable agenda for the 21st century. In the United States and Canada, the

National Committee for World Food Day will air the sixth annual World Food Day satellite teleconference. Particular focus will be given to the threat of environmental degradation to future world food security.

An article in the June 1989 edition of *National Geographic* magazine estimates that a million species will be lost in the next 25 years — a rate of one every 15 minutes. In May 1988, when he was Vice-President, George Bush said "We face the prospect of being trapped on a boat that we have irreparably damaged — not by the cataclysm of war but by the slow neglect of a vessel we believed to be impervious to our abuse." Active participation by people the world over is necessary to establish and sustain environmentally sound agricultural systems to preserve and nurture life on earth as we know it. ■

John J. Nicholaides III  
Director, Associate Dean, and  
Assistant Vice-Chancellor for Research

social reforms and the application of improved technology, increased its grain output by about 50 percent in a mere eight-year period between 1976 and 1984.

Such rapid progress in food production is unprecedented. There is growing concern, however, that this progress cannot be sustained. For example, cereal production in China, India, Indonesia, and Mexico has been essentially static during the past four years. From 1984 to 1988, worldwide per capita production of cereals has declined each year — for a total of 14 percent over the four-year period. Global grain reserves in 1989 are expected to be at the lowest level since World War II.

It is still uncertain whether this drop in agricultural output is a short-term aberration due to unfavorable weather conditions or whether it is the beginning of a long-term trend that could have disastrous consequences — particularly for many parts of the developing world already suffering from inadequate levels of food. Many circumstances suggest it could be a long-term trend.

For example, the Earth's population continues to grow at a rate of 1.6 to 1.7 percent, resulting in almost 90 million more consumers of agricultural products annually. Moreover, 90 percent of this growth is occurring in the developing world, many parts of which are

already suffering from inadequate food supplies.

Such growth in population not only substantially increases the demand for food year after year, but this greater number of people contributes to environmental problems and the degradation of natural resources in ways that threaten the continuing productivity of many agricultural areas. Indeed, in both industrialized and developing countries, many of the natural resources on which agriculture depends have deteriorated significantly.

Intensification of traditional agricultural systems to meet growing needs often has had undesirable environmental or ecological consequences. Increased demand for fuelwood and increased need for agricultural areas to cultivate have caused significant deforestation and related soil degradation. The increasing need for food has forced farmers to clear and cultivate hillsides and other fragile lands, resulting in erosion and loss of soil productivity. In many areas, water reserves are being depleted. The forage needs of livestock in many developing countries now exceed the carrying capacity of grasslands — in some areas by as much as 50 to 100 percent. This overgrazing results in the deterioration of rangelands, often leading to desertification. Air, soil, and water are being contaminated by the waste products of industry, urban development, and

some agricultural practices; and the still uncertain, long-term effects of global warming could be enormous in terms of the food-producing capability of many parts of the world.

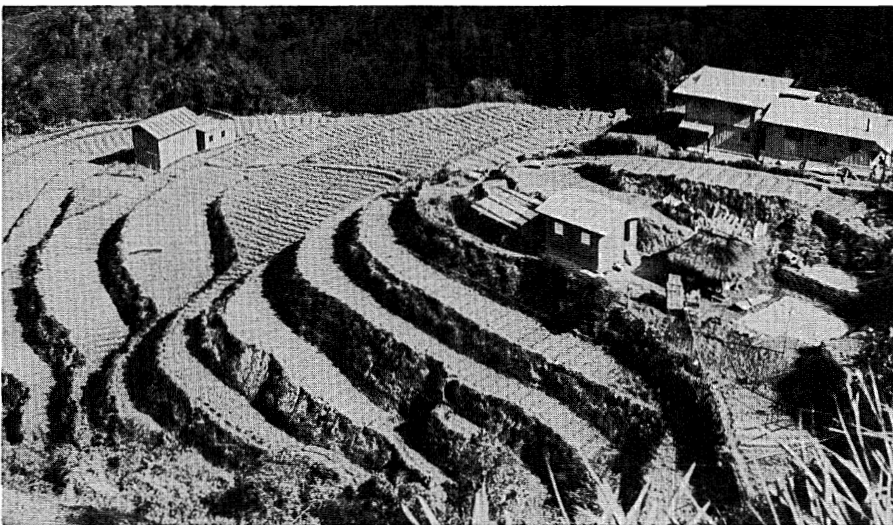
**CGIAR.** These are some of the circumstances that have been of major concern to the Consultative Group on International Agricultural Research (CGIAR) and its Technical Advisory Committee (TAC). CGIAR is the organization responsible for the thirteen international agricultural research centers (IARCs), which have contributed significantly in recent decades to improving food production in the developing world.

In its study of CGIAR strategies and future priorities, TAC recommended that the system's goal of increasing Third World food production be modified: CGIAR should emphasize increasing *sustainable* food production in the future work of the international centers. In accepting this recommendation, CGIAR asked TAC to indicate how the emphasis on sustainability could be implemented.

**Sustainability.** A dictionary definition of sustainability refers to "keeping an effort going continuously, the ability to last out and keep from falling." Such a definition would suggest that agricultural systems would be sustainable if production could be maintained at current levels. This would be a static concept, however. TAC suggested that sustainability should be treated as a dynamic concept, reflecting changing needs, especially those of a steadily increasing global population.

In the static sense, many traditional systems of agricultural production were sustainable for centuries in terms of their ability to meet continuing, stable levels of production. However, the needs and increasing aspirations of expanding numbers of people have forced changes in land usage and imposed excessive demands on natural resources, making the modified farming systems unsustainable.

The goal of a sustainable agricultural system should be to maintain production at levels necessary to meet the



Photograph courtesy of E. T. York Jr.

Over centuries, farmers have developed sustainable agricultural systems such as this one found in a steep mountain area in Indonesia. Research is exploring ways to make traditional systems even more productive while maintaining their sustainability.

increasing aspirations of an expanding world population without degrading the environment: it implies concern for the generation of income, the promotion of appropriate policies, and the conservation of natural resources. This concept suggests, therefore, that sustainable agriculture should involve the successful management of resources for agriculture to satisfy changing human needs while maintaining or enhancing the quality of the environment and conserving natural resources.

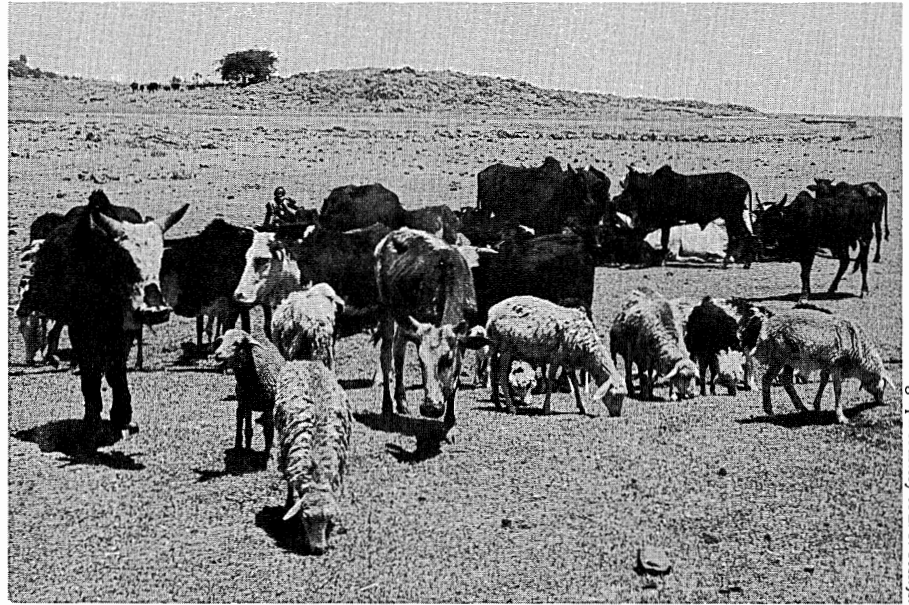
In 1988, TAC completed a major study of sustainable agricultural production, with particular attention devoted to implications for international agricultural research and the networks of centers that are a part of CGIAR. Published by the Food and Agriculture Organization (FAO), the report of the study is entitled "Sustainable Agricultural Production: Implications for International Agricultural Research." This study considered in detail the physical, biological, socioeconomic, and legal determinants of sustainability and how its many obstacles might be addressed through research. Moreover, the report summarized some of the current research of the international centers on sustainability and suggested areas of future research emphasis.

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### TAC did not consider low-input practices to be a necessary corollary of efforts to achieve sustainability.

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TAC noted that much of the research of the IARCs was already concerned with achieving the objectives of sustainability. It was recognized, however, that concern for sustainability should be reflected in production research and that research should be planned, carried out, and evaluated from the perspective of sustainable agriculture. In considering short-term versus long-term objectives, TAC recommended that the goals of IARC research should be to devise



Photograph courtesy of E. T. York Jr.

Overgrazing of pasture lands poses serious threats to sustainability in many areas of Africa.

technology to meet short-term requirements while maintaining or enhancing the ability to meet long-term needs.

TAC acknowledged that the use of commercial or industrial inputs, especially fertilizers and pesticides, raises many issues related to sustainability. Some believe that high levels of inputs threaten sustainability; others suggest that increased productivity and sustainability cannot be achieved without greater use of inputs. TAC did not consider low-input practices to be a necessary corollary of efforts to achieve sustainability — as some are advocating. Indeed, under some circumstances, relatively high levels of inputs may contribute to its objectives. TAC suggested that research should attempt to develop techniques that might optimize the use of inputs while avoiding, as much as possible, any undesirable consequences.

Although traditional farming systems may become inadequate in terms of growing needs, the principles on which they are based have permitted them to persist for generations. There are dangers both in disregarding these principles and in assuming that they are always appropriate. Expanding requirements for food in developing countries suggest the need to continue investigating aspects of more intensive and productive systems that could evolve from sound traditional systems.

**Needed research.** Although the IARCs and national research systems are already making important contributions to solving the problems related to sustainability, the current effort probably does not adequately or rapidly enough address the needs. Most current expenditures for research on productivity merely maintain past gains. Research activities must be expanded in a number of critical areas, including:

- developing improved production systems that lead to greater productivity and sustainability;
- improving the productivity and sustainability of agriculture in less-favorable environments;
- managing natural resources and preventing their degradation;
- facilitating the restoration of land already degraded;
- incorporating new techniques of biotechnology, which offer promise for accelerating progress, into current research programs;
- addressing many policy problems that may limit the achievement of objectives of sustainable agriculture, recognizing that a wide array of problems that threaten sustainability relate to economic, social, political, and institutional considerations;
- developing more effective means of controlling agricultural pests and meeting nutrient requirements of

plants without polluting the environment and threatening human health.

Much progress is already being made in many of these areas.

**Common challenge.** The U.N. Commission on Environment and Development has characterized sustainable development as "development that can meet the needs of the present without compromising the ability of future generations to meet their needs." This is a goal to which agricultural programs and production systems all over the world must be committed. Failure to do so could mean that short-term gains presently enjoyed could threaten our ability to meet long-term needs.

The common challenge is to remove the technical, economic, social, institutional, and political impediments to sustainable agricultural production. Such efforts offer opportunities for unprecedented contributions to the global community by solving problems that threaten the future welfare of humanity. □

*E. T. York Jr. is distinguished service professor, University of Florida, Gainesville. He earlier served as the chancellor of the State University System of Florida and as interim president, executive vice president, and vice president for agricultural affairs at the University of Florida. From 1961 to 1963, he was administrator of the Federal Extension Service, U.S. Department of Agriculture. Dr. York has led numerous task forces on agricultural development and education for the U.S. government and private organizations, including presidential missions to Central America and the Caribbean, Egypt, and Liberia. From 1980 to 1986, he was a member of the Board for International Food and Agricultural Development (BIFAD), serving as chairman from 1983 to 1986. He was also a member of the Technical Advisory Committee (TAC) of the Consultative Group for International Agricultural Research (CGIAR) from 1983 to 1986.*



Photograph courtesy of the U.S. Agency for International Development

These newly planted filao trees, on an AID-financed project in Senegal for dune stabilization, require only 10 centimeters (4 inches) of rain a year.

## International Concern for the Environment Brings New USAID Initiatives

William R. Furtick

Much is at stake for the environment in the developing world. Tropical forests, centered in the Third World, are home to half of the Earth's plants and animals.

Regions that once were rich forestlands have been razed for human settlement. Especially in the Third World, where the population continues to boom, the pressure of humanity on the environment is becoming ever more critical. In Africa, millions of lives hang in the balance, depending on climate and the management of natural resources.

Stewardship of the environment is not a responsibility reserved for wealthy, industrialized nations. The burgeoning population of the Third World has just as much at stake in — and effect on — the world's environment.

**Role of USAID.** The battles to preserve the tropics, fight the encroaching desert, save the forests, conserve

productive soil, and contain manufactured environmental risks are being waged today in the developing world. Through its worldwide foreign aid programs, the U.S. Agency for International Development (USAID) is helping to ensure that humanity's growth does not upset nature's delicate balance.

The natural tension between growth and the environment gave rise to the U.N. Conference on the Human Environment at Stockholm in 1972. USAID was one of the first donor agencies to adopt procedures that make environmental concerns a key part of the design and implementation of development projects. In 1977, this concern was made the law of the land when the Foreign Assistance Act was amended to add "environmental and natural resources" to USAID's mandate.

"The environment is a vital part of the development process," said former USAID Administrator Alan Woods.

"We're proud of the Agency's achievement in integrating environmental concerns into development."

The Agency takes seriously its commitment to the environmental integrity of its projects, with practical results. For example, experts at USAID found that a rural development project in Costa Rica was too close for comfort to an ecologically important wetland. The area is home to many endangered species: the jaguar, ocelot, tapir, paca, and jabiru stork, whose eight-foot wing span makes it the largest stork in the world. USAID made its support for the development project dependent upon the designation of the Cano Negro site as a wildlife reserve. The government of Costa Rica agreed. Today, USAID helps maintain the site as an enclave for exotic creatures. At the same time, the prudent rural development of that Central American country is progressing with U.S. assistance.

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## Many varieties of plants and animals could disappear without ever being discovered by humans.

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**Endangered resources.** One of the most pressing environmental problems in the world today is the destruction of tropical moist forests, which cover only about 7 percent of the Earth's face but are an important part of its ecology. Deforestation currently claims 80,000 square kilometers (49,680 square miles) of forest per year; the land is converted to agriculture or falls victim to excessive burning, grazing, wood gathering, or industrial exploitation.

As many as one million species — up to one-fifth of the planet's total — could perish along with the forests by the year 2000. It is tragic to note that many varieties of plants and animals could disappear without ever being discovered by humans.

The value of some of the endangered resources is known: the camucamu fruit from the jungles of Peru has 10 times the vitamin C content of an

orange; the periwinkle plant found in the Caribbean is an ingredient for treating Hodgkin's disease and lymphocytic leukemia; and drugs for treating malaria and glaucoma originate in the tropical Amazon.

USAID has set out to help save these and other valuable resources from the ravages of mismanaged expansion. The Agency has worked with experts in and out of government to draw up a strategy for conserving biological diversity.

From Madagascar to Peru and Nepal, USAID projects are at work developing careful uses for unique resources. Recognizing the precious assets that are at risk in the Third World, USAID is helping nations grow with their environment, not against it.

For instance, a vine in Peru produces a seed that, when dried, burns with a clear blue flame; it could be an efficient substitute for kerosene and charcoal. Researchers in Peru also have discovered a tree species whose bark contains a substance regarded as a promising treatment for some forms of cancer.

The increasing demand for tillable land and fuelwood in Latin America has threatened not only rare plant varieties but also whole forests. Central America was once blanketed with thick forests; today, less than half of it is forested.

One response has been USAID's project on Fuelwood and Alternative Energy Sources. Based in Costa Rica, this project has identified fast-growing trees that can be planted specifically to provide a ready source of fuel. Trials conducted throughout the region have identified thirty promising species of trees that are now being adopted by farmers.

Haiti has been particularly hard hit by deforestation. USAID is working through private groups to plant millions of trees in that island nation. Farmers cut down trees as a matter of survival because they need wood for cooking, building their homes, and for making charcoal to sell. The United States is encouraging some farmers not to tear down naturally forested areas but to plant and carefully harvest trees

as a cash crop on their own land. One creative program is providing Haitian farmers with plants that bear avocados and other marketable fruit. In addition to providing income for farmers, this project plants new trees and helps prevent hillside erosion.

USAID's largest forestry effort is under way in Asia. Projects in Indonesia, Nepal, the Philippines, and Thailand are seeking to establish systems of upland management that reduce environmental damage and incorporate sustainable agricultural practices. One of the longest term efforts, based on nearly two decades of research in the Amazon areas of Peru, has centered on finding alternatives to slash-and-burn agriculture. Support also is provided for several major rural programs to plant trees in South Asia aimed at meeting the multiple needs of rural communities for fuel, fodder, fiber, income, and soil conservation.

As in developed countries, many of the environmental risks in the Third World are created by humans. For example, the pressure to increase agricultural yields has made use of pesticides a common practice. World pesticide sales grew from US\$8 billion in 1972 to almost US\$13 billion in 1983. The most rapid growth occurred in developing countries, where there is less awareness of pesticide toxicity.



A nursery worker sorts seedlings in preparation for planting. Small tree nurseries, such as this one in Pakistan, are scattered throughout a project area.

Photograph courtesy of the U.S. Agency for International Development

Farmers there often do not have the knowledge or the facilities to use the products properly.

Cooperating with the World Bank, USAID is trying to help educate these people in the safe use of pesticides. Two years ago, these organizations developed guidelines for pesticide use. USAID also is providing US\$6 million to fund a Costa Rican-based integrated pest management project that will provide training and technical assistance to deal safely with pest problems.

#### Planning requires information.

For any country to manage and protect its natural resources, it must first produce an overview of the environmental situation. The United States has helped dozens of developing countries develop profiles of their environment and natural resources. In Honduras, a U.S.-supported environmental profile was put to good use in drafting a plan to halt soil erosion in a major Choluteca watershed area. Working with experts in Thailand, USAID helped develop a profile that was used in devising a first-of-its-kind, five-year environmental plan.

USAID has extended a hand to some countries in designing a comprehensive strategy to integrate conservation of natural resources into the development process. Conservation strategies have been funded in Nepal, the Philippines, Sri Lanka, and Zimbabwe. The Agency takes care to work with local institutions and conservation groups to nurture concern and expertise in these countries.

"In the years ahead, USAID will play a key role in the effort to apply human knowledge to make economic development a process that not only sustains but enriches the Earth's natural heritage." If the environment is to be protected, agriculture must be the core of the effort. Most of the forests are cut for fuel or to expand farming. Deforested land is used mainly for either cultivated agriculture or for livestock grazing.

The new USAID statement on agriculture recognizes this use by emphasizing the protection or enhancement of the natural resource

base on which sustainable agriculture is dependent. U.S. universities are providing leadership in this effort through the Board for International Food and Agricultural Development (BIFAD), a congressionally established group appointed by the President to bring the expertise of universities to bear on the needs of USAID in food and agricultural development. BIFAD has established a Panel on Sustainable Agriculture, which includes representatives of environmental organizations, to design specific strategies and initiatives for providing leadership in ensuring that future agricultural development activities are environmentally sound and will lead to sustainable agriculture. This is part of a worldwide effort that is forging new partnerships between donor and development agencies, environmental organizations, and universities. □

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## Agricultural Sustainability for Developing Countries: An Urgent Agenda for U.S. Universities and Environmental Organizations

Robert O. Blake

The world may well be faced in the not-too-distant future with a serious crisis in feeding its 5.2 billion people. Global population is growing by more than 86 million people a year at the same time that international reserves of basic grains are declining and the economic resources of poor nations continue to weaken. These facts present a new and especially difficult challenge for developing countries, many of which are already faced with populations that are doubling every twenty to thirty years, huge numbers of undernourished people, stagnating agricultural productivity, and — too often — rapidly degrading farmland.

How will they — and we — achieve sustainable farming systems so that not only this generation but also future generations can be fed? There are few signs that population growth will level off anytime before the middle of the next century. So how, in the meantime, do we produce enough to feed the world, ensure that this production is on an environmentally sustainable basis, and improve the food security of the poor?

The citizens of the United States and other industrialized nations, more specifically those who are members of academic communities and environmental organizations, hold many of the keys for helping developing nations solve these problems. We can help them to better apply the tools of a science and technology that are suited to the needs and aspirations of their farmers for a richer and more productive life. We can help them mobilize the will and the resources to sustain agriculture and secure their food supply for future generations.

We already know more than enough to make real advances toward putting agricultural production on a sustainable basis, even in the case of less well endowed land. In the U.S. Agency for International Development (USAID), World Bank, regional banks, bilateral aid-givers, and international agricultural research centers (IARCs), we have an institutional framework capable of advancing sustainable agriculture. It is becoming clearer every day, however, that these organizations and the citizens of the United States have not given this issue a high enough priority.



Photograph courtesy of the Inter-American Development Bank

In this project financed by the Inter-American Development Bank, laborers using small hand tools make terraces on the mountainside at Dofourmi, 1,100 meters above Port-au-Prince, Haiti. Trees were planted on the terraces to reforest the mountain, stop erosion, and create a watershed to decrease water runoff after rainstorms.

**Two developments.** Two recent events underline the increased importance being placed on agricultural sustainability. The first was the formation by a coalition of environmental organizations, private voluntary organizations (PVOs), and development and policy research groups in 1987 of the Committee on Agricultural Sustainability for Developing Countries. The Committee has since expanded by the addition of new member organizations and a growing number of university and scientific advisers actively involved in the agricultural development of the Third World. The Committee has also begun to work with like-minded organizations in other countries, particularly in the developing world.

The second development was the decision by a growing group of U.S. university leaders to join in the effort to help the developing world achieve agricultural sustainability. This decision was discussed at three meetings organized by the Board for International Food and Agricultural Development (BIFAD) staff and strongly supported by the National Association of State Universities and Land-Grant Colleges (NASULGC). The conclusions and recommendations coming from those meetings already seem to have catalyzed new ideas about sustainable agricultural development and about how U.S. universities can contribute.

**Role of the Committee.** The Committee on Agricultural Sustainability for Developing Countries began its work by examining the agricultural development record of USAID and international financial institutions, particularly that of the World Bank. We are urging those institutions and the United States Congress to give sustainability in agricultural development the high priority that it requires and deserves.

How well are these development organizations doing and what particular problems do they face? Do they have policies that ensure the sustainability of their own agricultural development programs? More

importantly, are these policies producing programs that contribute substantially to this purpose? The answers to these questions are complicated and different in the case of each institution.

**USAID.** USAID has gone farther than other donor organizations in thinking through what agricultural sustainability means in practice. This thought is reflected in what they say about agricultural development and is incorporated into their training programs. Most USAID missions have had difficulty in rigorously applying these principles to their own projects, and they must constantly be encouraged to do a better job. Unfortunately, as federal funding for agricultural development in developing countries becomes more scarce, USAID has tended to look for easier projects with the "biggest return" rather than for those that make the biggest contribution to sustainable agriculture. This unwise decision is reflected in a tendency to give less attention to small-scale farmers, particularly those on rain-fed lands. Nevertheless, overall, USAID stands out for its focus on the bottom-up approach to agricultural development, on the need for on-farm trials for research, and on the need to work closely with farmers in establishing research agendas. Even though USAID is a leader in this field, it must be helped and encouraged to do an even better job and to expand these efforts to more farmers in more countries.

**World Bank.** The World Bank is a huge organization, with many currents and countercurrents of thought and action. Unlike USAID, it is operationally centered in Washington, D.C. The Bank's agricultural programs are rhetorically, if not yet very specifically, committed to agricultural sustainability. The Bank's year-old environmental department is just getting started, however, and it still seems to lack the strength to require the vital regional operations departments to take the time and care required in agricultural development projects. For example, irrigation projects still are too

often carried out too quickly without enough continuing supervision and without enough participation by associations of irrigation users. Despite rhetorical commitment to the welfare of the rural poor, the Bank too often emphasizes spending a lot of money for large projects rather than seeking out projects for poor farmers operating under complicated conditions. These tendencies must be overcome. Fortunately, the Bank is full of good people who are well aware of these problems — people who reflect more deeply every day about the environmental consequences of what they are doing.

IARCs. The international agricultural research centers, too, are dedicating more of their efforts to achieving sustainability. Individually and collectively they have been mandated to incorporate principles of sustainability more fully into their research programs. Some centers are further along this path than others. Figuring out how to divide their finite resources between cropping systems and plant breeding for the best lands and those for less well endowed lands is a continuing problem, as is how to ensure against a top-down approach to research. Overall, despite some progress, most of the international centers can still do a better job in focusing on sustainability.

**Move forward.** In sum, despite a certain unevenness, there has been progress by these important institutions in the way they help developing countries carry out agricultural development. But it is urgent to move more rapidly toward sustainability. The advances made so far just are not good enough or widespread enough to touch more than a small number of farmers of the developing countries or to help produce enough food for their rapidly growing populations. There is another serious impediment to the adoption of principles necessary for sustainability: too many governments still believe that they cannot afford to conserve their precious soils, water, and forests. Too often they fail to recognize that the costs of protecting

their resources now are infinitely lower than the costs of trying to restore them later.

It is clear that we must do what we can to change this situation. By we, I mean the members and organizations of our Committee and the members of university and scientific communities who participate in agricultural research. In this regard, I suggest a short list of priorities for the readers of the *International Agriculture Update*:

- Involve yourselves more deeply in persuading IARCs, U.S. university communities, and USAID — particularly through its collaborative research efforts — to focus more sharply on sustainability.
- Work in universities, private voluntary organizations, and aid-giving institutions to establish more realistic, multidisciplinary, and culturally sensitive training in methods of sustainable agriculture for students from developing countries.
- Do more to ensure an effective farmer-based participatory approach, not only to research but also to all aspects of Third World agricultural development.
- Work to convince aid-giving agencies and IARCs that they must not neglect the small-scale farmer on less-favored rain-fed lands — land that supports so much of the Third World's agriculture, population, and potential production.
- Work to help aid-giving agencies and IARCs come to terms with the institutional problem of how to move from successful but site-specific village-scale efforts toward sustainability to broad-scale application and adaptation of such models to thousands of villages and hundreds of thousands of farmers in similar situations. American PVOs will be leaders and allies in this effort. But, as they point out, PVOs cannot possibly do the whole job, and they look to the university community for help.
- Work together with other members of environmental organizations, PVOs, and the university and scientific community to convince Congress to give USAID, the World Bank, regional banks, and IARCs the

increasing levels of resources they need to contribute to the absolutely essential effort for longer term global food security.

There are, of course, many other problems that Third World farmers and governments must face. Most of these problems, however, loop back to the priorities that I have suggested. If together we can make some progress on these fronts in the next year, it will make a good beginning. More effort from all of us is required for building a consensus and finding better ways for common action. □

*Robert O. Blake is chairman of the Committee on Agricultural Sustainability for Developing Countries. He also serves as senior fellow, vice chairman, or member of the board of trustees or board of directors of eight conservation and environmental organizations. His long, diplomatic career included postings to France, Japan, Nicaragua, Tunisia, USSR, and Zaire, and from 1970 to 1973 he served as U.S. ambassador to Mali. Mr. Blake was a member of the U.S. delegation to the United Nations, deputy assistant secretary of state, and senior advisor on international environmental affairs to the administrator of the Environmental Protection Agency.*

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Update

The rural poor suffer most from deteriorating environmental conditions — silted and polluted water, lack of firewood, erosion, flooding, and desertification. Intensifying agricultural production to meet growing needs sometimes has undesirable environmental or ecological consequences and can contribute to the deterioration of natural resources and living conditions of people in much of the developing world.



Photograph by Karen L. Russon

## The Common Challenge: Providing a Sustainable Future

In July 1988, the environmental crisis was acknowledged at the highest levels of government when top-ranking environmental officials participated in an economic summit meeting of the Group of Seven (Canada, England, France, Germany, Italy, Japan, and the United States). Action now must follow the understanding that the world is faced with problems that threaten the future welfare of humanity.

Our task is to remove the technical, economic, social, institutional, and political impediments to sustainable agricultural production. Our goal is to increase agricultural production to levels necessary to meet the needs of an expanding world population without degrading the environment.

In this, the third issue of the *International Agriculture Update* that we are devoting to the environment, we are very pleased to bring you articles by guest authors Roger W. Findley, acting dean of the College of Law, University of Illinois at Urbana-Champaign (UIUC); Rodrigo Gámez, director of the National Biodiversity Institute, San Jose, Costa Rica; Michael E. Irwin, professor of international entomology, UIUC; and Guillermo A. Mendoza,

assistant professor, and Gary L. Rolfe, head, Department of Forestry, UIUC. Our authors present information on how Brazil and Costa Rica are addressing their challenges in trying to preserve their natural resources; explore one area of research that might help mitigate the conflict between cropland and natural areas; and discuss how agroforestry can promote sustainable agricultural systems.

Illinois has long been a leader in acknowledging the need to protect our natural resources. Engraved on Davenport Hall at UIUC are these words of Andrew Sloan Draper, president of the University of Illinois from 1894 to 1904: "The wealth of Illinois is in her soils and her strength lies in its intelligent development." This concept needs to be extended worldwide; we need to know what we have and use it wisely. Now is the time for the world's human resources to make the right choices about the world's natural resources, or we run the risk of having neither in the future. ■

John J. Nicholaides III  
Director, Associate Dean, and  
Assistant Vice-Chancellor for Research

## Development, Preservation of Tropical Biological Diversity, and the Case of Costa Rica

Rodrigo Gámez

Our world is in serious trouble. Numerous, complex, and inter-related factors are rapidly degrading the environment and threatening the very existence of life on earth.

The present structure of the international economic system and the unequal distribution of the world's wealth and resources widen the gap between developed and developing countries and create pressures for development that may be ecologically unsound. Population growth rates are very high, particularly in the poorest nations. Massive numbers of species are becoming extinct, mostly the result of tropical deforestation. Consumption patterns, energy technology, and industrial processes generate huge amounts of waste, toxic materials, and gases that pollute the environment and alter the earth's atmosphere and climate.

Ecological losses in the tropics are getting worldwide attention. Biological diversity — concentrated, for the most part, in tropical areas — is being destroyed at an ever increasing rate with the disruption of entire ecosystems. Tropical countries encounter numerous problems and conflicts as they create models of development and systems of production that can satisfactorily support their populations and still preserve their natural resources.



Photograph by Michael E. Irwin

La Amistad Nature Reserve in Costa Rica. There is a serious impediment to the adoption of principles necessary to preserve natural resources: too many governments still believe that they cannot afford to conserve their precious soils, water, and forests. Too often they fail to recognize that the costs of protecting their resources now are infinitely lower than the costs of trying to restore them later.

**Population pressures.** Tropical deforestation is closely linked to overpopulation and poverty. Nearly 75 percent of the world's population lives in tropical developing nations. This mass of people, however, controls less than 15 percent of the world's wealth.

Most tropical countries are squandering their natural resources, even though their economies and most of their rapidly growing populations depend heavily on these resources. National and international pressure make it difficult to implement policies for land use and economic planning. Modern, sustainable systems of agricultural and forestry production are badly needed, but few examples of their development or application exist.

Dramatic increases in the production of food and fiber are required to fulfill the basic needs of this population. It is frequently stated that increased production in tropical countries must come from intensified agricultural production. What is not appreciated is that increased tropical agricultural production usually demands much care, attention, and — often unavailable — energy and chemical inputs.

Although lack of appropriate technology is a major component of low productivity, it is not the only cause of agricultural problems in the tropics. Most tropical regions can be classified as marginal farmland with widely fluctuating productivity because of soil types, climatic conditions, fragility of ecosystems, diversity of pests and diseases, and other natural characteristics.

**International web of policies.** Both domestic and extratropical social, economic, and political pressures determine, to a large extent, the misuse and destruction of tropical resources. Industrialized countries often promote

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We are all part of the  
web; preserving tropical  
biodiversity is a concern  
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political borders.

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social aspirations and consumption patterns based on their own models — models that may be irrelevant to the needs and potential of tropical countries. All too often, tropical resources are sold to temperate countries at low prices that do not reflect their true value.

Most tropical countries historically have exported only a few agricultural commodities and raw materials to generate foreign exchange. Dependence on a few products renders the economy of these countries inordinately vulnerable to fluctuations in climatic conditions, international market prices, and other social and economic factors that are largely beyond their control.

As an example, the chronic balance-of-trade problems of Central American countries were exacerbated during the economic crisis of the late 1970s. This crisis contributed to the explosive growth of the foreign debt, which now represents one of the major environmental problems of Latin America. Debt-related economic problems increase the pressure to expand exports of natural commodities. This expansion, in turn, leads to greater exploitation of natural resources.

**Aid and the environment.** International development agencies have helped governments open up new areas by building roads and developing the infrastructure needed to expand production. Expansion, however, results in more intense use of natural resources and destruction of forests. Traditionally, minuscule amounts of economic assistance go toward conserving or protecting natural resources, whereas exorbitant sums are invested in military aid, highways, dams, and other large projects, which are implemented with little consideration of their environmental impact.

In Central America, this pattern of assistance has intensified environmental problems. Supported by international agencies, government policies to stimulate export-oriented agricultural commodities often have

discouraged the production of basic food crops for domestic consumption. Most tropical countries devote their most productive land to growing export commodities.

The shortage of agricultural land for food production and the lack of other employment options promote the colonization of the remaining remote forests and consequently are two of the major causes of tropical deforestation. Lumber provides a quick source of start-up capital, and in a relatively short time, landowners can convert wild vegetation to crops and pastures to obtain badly needed cash. Yields are low and not sustainable because this type of subsistence farming usually is practiced on marginal lands by the poorest and least politically influential sectors of the population.

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## To protect this biological wealth, Costa Rica developed a conservation program still unmatched in the tropical world.

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In this harsh socioeconomic environment, Costa Rica and other tropical countries must strive to preserve their biodiversity. We are all part of the web; the destruction of tropical resources results from both internal and external pressure. Preserving tropical biodiversity is a concern and responsibility that should transcend political borders.

**Costa Rica.** Situated on a narrow bridge of land between two continents and two oceans, Costa Rica's geography, topography, and climate have created a mosaic of ecosystems. Its forests provide a myriad of habitats containing thousands of species. Costa Rica is thought to have more species per unit area than any other land mass on Earth. Current estimates

indicate that 5 to 7 percent of the known biodiversity of the planet — probably not less than half a million species of mostly undescribed organisms — are found in Costa Rica.

To protect this biological wealth, Costa Rica developed a conservation program still unmatched in the tropical world. A system of parks and reserves comprises nearly 27 percent of the country and preserves samples of most of its known habitats.

Several factors contributed to Costa Rica's success in preserving its natural heritage:

- the opportunity to establish the system while there was still time to save substantial portions of the country from destruction,
- the initiative, enthusiasm, and commitment of a large number of Costa Ricans,
- wide national and international support,
- the stability provided by an unarmed democracy and the satisfactory attention to the basic socioeconomic needs of the population, and particularly
- the political support that conservation has received from the five administrations since the system was established nearly 20 years ago.

Costa Rica has shown that political and national will are more important than economic considerations in determining the success of a country's conservation program.

**Maintaining progress.** Preserving areas now does not guarantee perpetual conservation. In Costa Rica, deforestation, environmental degradation by traditional and modern agricultural practices, a rapidly growing population, and uncontrolled urban development threaten natural resources and protected wildlands. In order to survive, the concept of nature and natural areas must be embedded culturally, intellectually, and economically into the society.

**Regional units.** Congruent with the concept of sustainable development, Costa Rica is seeking to develop a model in which protected wildlands become an integral part of a region's rural development program. The traditional concept of a national park as a piece of land protected from external socioeconomic pressures is rapidly evolving into regional units of conservation and development in which protected wildlands are integrated into the agricultural landscape.



Photograph by Karen L. Russon

Planting on recently cleared land in Honduras. Developing countries are many times more dependent than industrial countries on their natural resource base — their soils, water, fisheries, forests, and minerals. Within these countries, the poor are the most dependent of all. Heavy or other inappropriate use of fragile lands — overgrazing, overcutting, overfarming, overpopulating — is undermining prospects for development.

These units are expected to fulfill basic needs of the country and, in particular, the rural population. Units comprise three distinct types of sustainable land use:

- areas for absolute protection of biological diversity,
- areas where resources are harvested and biodiversity is a subproduct, and
- areas where resources are intensively exploited and little or no consideration is given to protecting biodiversity.

Neighboring communities can benefit from increased nature-oriented tourism and scientific activities in the wildlands and a more efficient agroforestry industry.

The model of regional units is being rapidly implemented. The government is contemplating innovative changes in their organization and administration, including wider and more direct participation of local and national organizations and institutions.

Communities are expected to assume more responsibility for protecting and managing these areas. Private non-governmental organizations play an important role in the financial administration and development of the new program. Funding for this program comes from a variety of local and international sources.

Debt-for-nature swaps. An innovative initiative of debt-for-nature swaps has substantially consolidated the new system, and the swaps help to reduce the burden of Costa Rica's huge foreign debt. International organizations and conservation groups purchase debt titles at 15 to 20 percent of their face value. The Central Bank of Costa Rica then trades the titles for local-currency conservation bonds, multiplying three to four times the original amounts received from international donations. Because this initiative internalizes the debt, however, it could have an inflationary impact on the economy of the country, a significant inherent limitation.

**Putting biodiversity to work for society.** Other steps are necessary to guarantee the permanent protection of biodiversity. In addition to preserving wildlands, it is necessary to know what biota is contained in these areas and where it is.

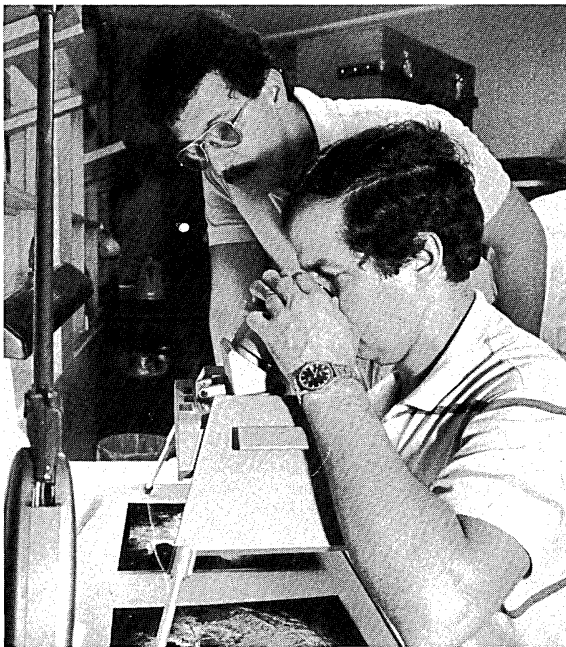
Costa Rica is initiating a ten-year program to inventory its natural areas and the more than 500,000 species of flora and fauna found in them. The inventory will be made by Costa Rican parataxonomists and taxonomists who will collaborate with international taxonomists and scientific institutions during the survey.

Direct products of this inventory will include a national taxonomic collection for reference and research, a computerized database on biodiversity, field guides to all Costa Rican organisms, and a largely self-developed capability to carry out the above kinds of activities. A national biodiversity inventory with wide-scale local involvement will contribute to the intellectual enrichment of the country and to a deeper appreciation of the intrinsic value of nature.

Identifying and organizing the country's biota represent the first steps toward putting this biodiversity to work for society through agricultural, medical, or industrial uses. These applications could provide new crops or natural products and genes for diverse applications of biotechnology.

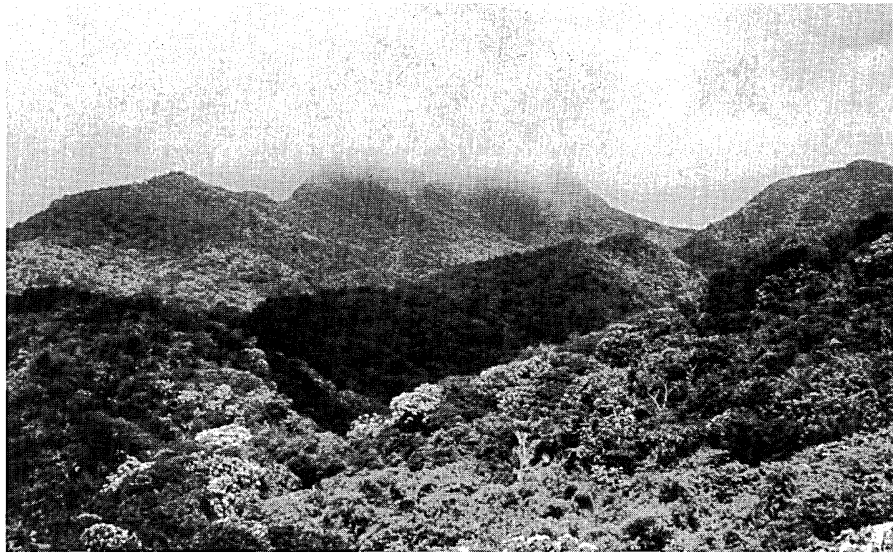
**An example.** Costa Rica's conservation program represents an indigenous answer to the complex problems of preserving tropical biodiversity and promoting sustainable development of the country. It also offers an example for other tropical nations to follow and an illustration to all countries of the issues and considerations that must be taken into account in our attempt to save our planet from environmental destruction. □

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Photograph courtesy of the Inter-American Development Bank

Map technician interpreting an infrared picture of the Gulf of Santa Elena, Guanacaste Province, Costa Rica. An Inter-American Development Bank grant to the Instituto Geográfico Nacional financed a study of land use in Costa Rica and established a permanent research system that uses satellite remote-sensing technology.



Photograph by Sandra Brown

Caribbean National Forest in Puerto Rico. The planet's greatest storehouse of biological diversity is its tropical forests; if current destruction continues, hundreds of thousands of species will become extinct by the year 2000. Across the globe, about 22 hectares (54 acres) of tropical forest disappear every minute.

## Agroforestry: An Ecological Approach to Land Management

Guillermo A. Mendoza and Gary L. Rolfe

Agroforestry is a new term coined from agriculture and forestry. As a land management system, agroforestry combines the production of forest plants and agricultural crops simultaneously or sequentially on the same unit of land. Possible strategies for agroforestry include intercropping, multicropping, successive cropping, and other cropping systems that provide both forest and agricultural products.

Agroforestry has long been practiced in one form or another in many developing countries, where this land-use system evolved out of the urgent economical and ecological need to meet the pressing and varying demands of rapidly increasing populations. In many Third World countries, large-scale, indiscriminate cutting of trees has deteriorated the environment considerably, resulting in significant loss of soil and nutrients and consequently reducing the productivity of many sites. In response to the alarming rate of forest exploitation and deforestation, agroforestry

systems were developed as an alternative that not only could meet the socioeconomic needs but also maintain and improve the productivity of forestland and avoid destructive on-site and off-site soil degradation.

Agroforestry systems are more ecologically sound than traditional agricultural systems. One of the most significant aspects is improved soil control, which reduces erosion while improving or maintaining the quality of stream water. Unlike traditional agricultural systems, in an agroforestry system, rows or strips of trees are interspersed with agricultural crops and planted on the contour of the land to stabilize the soil. These stabilized strips of land slow the flow of surface water and reduce channeling of water and erosion during heavy storms. The presence of cover year-round on a portion of the cropland provides an equally stable soil system, further lowering the erosion potential.

Tree strips interspersed with crops often have undergrowth that provide cover for an enhanced diversity of

wildlife and create transition areas between different ecosystems. By providing abundant habitat variation, transition areas promote a rich variety of wildlife species. Strips of forest vegetation also provide corridors for travel between larger forested blocks. Animals frequent these lanes of travel because of the effective cover and protection provided by forest vegetation.

Agroforestry systems should be the choice of land managers on sites with moderate to extreme slopes and fine-textured soils or other limits for normal agricultural use. Most agricultural lands that were originally forested fall into these high-risk categories. Agroforestry systems offer site stability and the opportunity to optimize productivity from these types of land. Worldwide, we should see increased attention devoted to agroforestry systems if we are to reduce soil erosion and sedimentation and improve the quality of surface water. □

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Photograph by Michael E. Irwin

Agriculture intruding into primary tropical forests near Foz de Iquaçu, Brazil. If scientists better understood the interaction of biota between natural and agricultural areas, we would be better able to manipulate the systems so that they would be mutually supportive.

## Biotic Interchanges Among Managed and Natural Ecosystems: Urgent Need for a Strong Research Agenda

Michael E. Irwin

**A** monumental conflict envelops the issue of land use, particularly in the tropics. On the one hand, we have the argument that agricultural production and lumbering activities must be increased to meet food, fiber, and construction needs and offset balance of payment deficits through expanded exports. Those holding this short-term view make a powerful case that meeting these needs benefits humanity in nutritional and economic ways. On the other hand, the persistent exploitation of our natural areas is depleting the biotic richness of our lands, diminishing the legacy for future generations, and restricting our access to diverse genes for future manipulation. An equally powerful argument, this long-term viewpoint recognizes that what is exterminated can never be replenished.

These seemingly opposing positions might be resolved in a manner that satisfies both factions. Aspects of natural systems may enhance forestry, agriculture, and other managed landscapes; similarly, aspects of managed landscapes may safeguard natural

systems and provide a formula for recovering biotic richness in pillaged habitats.

**Synergism.** Refugia, biological diversity, and genetic richness are three elements that seem to be important in fostering synergism between natural and managed systems. How the biotic components interact is of critical importance in addressing how to manage the systems.

**Refugia.** Refugia are parcels of land that retain, for one reason or another, unique flora and fauna — biota — during times when they would otherwise not be present. How agricultural oases and other biotically favorable, manipulated environments sustain species locally through times of natural emigration or diapause and how this affects the natural systems and managed landscapes are of pivotal consequence to both.

Irrigation in tropical agricultural settings can provide habitats favorable for the atypical overseasoning of some biota, avoiding the necessity to

emigrate or aestivate, that is, to remain dormant during dry periods. Irrigation could reverse the customary overseasoning habits of a variety of living things, especially in dry tropical forests. It could also alter the time of year biota invade natural systems from agricultural settings, with a conceivably enormous impact on both systems.

Similarly, natural areas harbor both pest and beneficial species that could either plague or safeguard agricultural and forestry products. The role of refugia in sustaining these systems is unknown; the repercussions, however, are undeniably profound.

**Biological diversity.** A portion of the diversity of life in one system will inevitably invade nearby systems; how this invasion affects the other systems is of considerable interest to conservationists and agriculturalists alike. If agriculture is thought of as an invasive system that receives much of its noncrop biotic diversity as colonists from surrounding systems, a long-term monitoring of colonization might be instructive in formulating models of invasion rates and classes of colonists through time.

Similarly, areas where agroforestry and agriculture are practiced could greatly influence the biological integrity of adjoining natural systems. For example, the introduction of the honeybee has probably had a great, although unmeasured, impact on natural pollinators in some areas. Monitoring insect herbivores and their natural enemies would help us develop models of biotic interchange.

**Genetic richness.** Any biological species consists of a number of populations. Each population includes a number of individuals, each with a slightly different genetic makeup. The genetic richness in a population purportedly equips that population to withstand environmental disruption, although this is not well understood. When a population from one system invades another, it is thought that a very restricted portion of the invading population manages to establish colonies. The result of this colonization has enormous consequences on the

sustainability of the invading population, especially in the area that is being invaded.

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Understanding the nature of genetic richness and how that richness affects invasion is important in designing sustainable agricultural and forestry systems.

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The genetic richness of invading populations might well be influenced by the proximity and relative sizes of the systems in question. Natural systems harbor genetically adaptable populations of harmful and beneficial species that continually invade agricultural systems. Similarly, agricultural landscapes probably contain genetically adaptable populations that continually invade natural systems. Understanding the nature of genetic richness and how that richness affects invasion is important in designing sustainable agricultural and forestry systems. Surprisingly little is known about this issue.

**Biotic links.** There is an inevitable exchange of biota wherever two ecosystems come into contact. Called an ecotone, this zone of interchange is, in a sense, a battleground for genetic and biotic dominance and for compatibility. When a natural system is ravaged by deforestation or by the introduction of agriculture, the system usually transforms in stages — from pristine forest to pasture, then possibly to high-input row-crop agriculture. An ecotone is established along the spatiotemporal border of this shift. This ecotone could well govern the rates and types of biotic interchange between natural and managed

systems. The role of a shifting ecotone in the ecological and economic balance of biota in natural and managed systems remains a mystery and demands investigation.

Refugia, biological diversity, and genetic richness are affected by successful movement of biota across ecotones. Physical surroundings have a profound effect on the ability of biota to move from one system to another. Energy, water vapor, and carbon dioxide are atmospheric characteristics that govern biotic balances in each system and surely affect this interchange. Pesticides and fertilizers in agricultural systems and other physical components have a direct impact on adjacent natural systems.



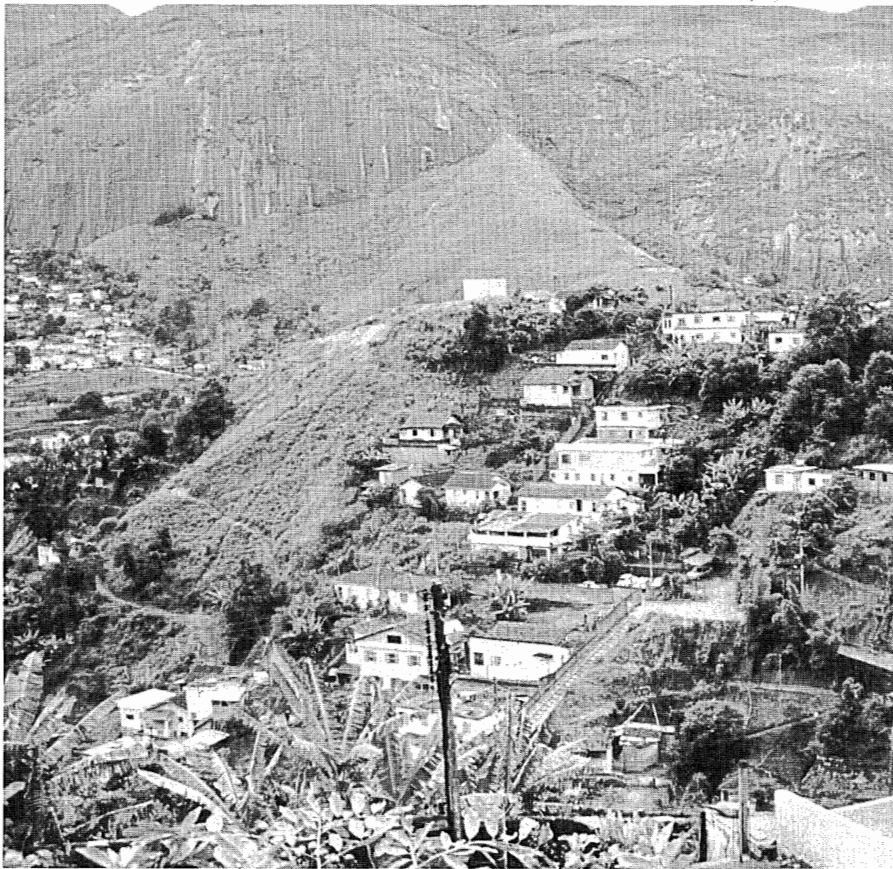
Photograph by Michael E. Irwin

Farmer in Indonesia. The pressure to increase agricultural yields has made use of pesticides a common practice. World pesticide sales grew from US\$8 billion in 1982 to US\$16 billion in 1986. The most rapid growth of pesticide use occurred in developing countries, where there is less awareness of pesticide toxicity, and farmers sometimes do not have the knowledge or the facilities to use the products properly. Every year 2 million people worldwide are poisoned by pesticides and, as a consequence, some 40,000 people die.

The spatial and temporal links between natural systems and agriculture can also influence the nature and, perhaps more importantly, the rate at which these interactions occur. The size and configuration of areas of land where agroforestry and agriculture are practiced in relation to the size and configuration of the remaining natural area, for instance, could be decisive in how managed expanses interact with natural systems.

Biotic movement between natural and managed ecosystems can have dramatic effects on both types of systems. As stewards of this planet, we must manage the effects so that they balance short-term with longer-term goals. The sobering realization is that we know so little about these interchanges and how they affect both types of systems. Time is running out for Earth's rich natural ecosystems. Our ability to sustain high-input agriculture also has a limited horizon. We must set a course that will uncover the biotic relationships between these systems so that they can be wisely managed in the future. A strong, timely research agenda that critically addresses these interactions is urgently needed. □

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Photograph by Alberto Nieto

Favelas, or shantytowns, on steep hillsides in Brazil. Poverty is a major cause and effect of global environmental problems. Fighting poverty requires defusing the underlying pressures on the world's resource base. We must confront rapid population growth, shortsighted economic policies that encourage the wasteful use of resources, and misguided development programs that have neglected environmental factors and local needs.

## Law, Politics, and Conservation of Brazil's Amazon Forest

Roger W. Findley

Having already cleared more than 10 percent of its Amazon forest, Brazil still possesses one-third of all remaining tropical forests in the world. Although about 60 percent of Brazil lies within the Amazon basin, only since 1960 have there been serious public and private efforts to integrate the Amazon region into the rest of the country and develop its economy in a sustained fashion. Previously, the isolation of the Amazon had been broken somewhat by a rubber boom in the nineteenth century and, in the first half of this century, by a spontaneous influx of peasant families from impoverished northeastern Brazil.

In the 1950s, because of greatly increased pressure on land in the states of São Paulo and Minas Gerais in the south, small-scale farmers began selling out to larger operators and moving northward to the state of Goiás and eventually beyond into the Amazon. This movement was accelerated by construction in 1960 of a 2,000-kilometer (1,200-mile) highway from Belém, at the mouth of the Amazon River, to Brasília in southeastern Goiás. For the first time, a road superseded rivers and cattle tracks as the main route into the Amazon. The road also meant that cattle ranchers and loggers could reach the important

markets of Belém and Brasília and, through Brasília, all of southern Brazil. The sudden accessibility of these markets brought about a rapid increase in land values, the entry of land speculators, and the beginning of violent confrontations over control of the land and the region.

**Military policy.** The military governments from 1964 to 1985 wanted to occupy the Amazon for two main reasons. First, they wanted to preclude occupation by settlers from neighboring countries, multinational mining companies, and other foreigners. Second, they believed that the Amazon should be occupied by wealthy and sophisticated economic groups rather than by peasant families with neither the resources to pay for the land nor the knowledge to develop it properly.

The military, therefore, developed a dual strategy to promote the type of occupation it wanted. First, it worked out a scheme to attract large economic groups by government subsidies to compensate for initial losses. Many subsidized companies established cattle operations. Under a 1966 law, companies could receive rebates of up to 50 percent of the income tax payable on all their operations throughout Brazil if they invested the money in approved farming or industrial projects within the Amazon region. From 1966 to 1968, more than 350 cattle-ranching projects were established and generated US\$1 million in tax rebates.

The second aspect of the government's development strategy was an ambitious program for building roads in the Amazon in the late 1960s and early 1970s. The five most important new roads, totaling about 10,000 kilometers (6,200 miles), cut through enormous areas of previously inaccessible land south of the Amazon river.

**Peasant influx.** Although the roads were constructed primarily to allow big cattle companies to move in, they also increased the speed of





peasant migrations. The population of the Amazon region more than doubled from 1960 to 1980, growing to more than 12 million people. The big states of Goiás, Mato Grosso (divided into two states in 1979), Pará, and Rondônia were most affected; the occupation front only reached the outlying areas of Amapá, Roraima, and Acre in about 1980. The government provided very little assistance or even guidance to peasant families about where they could legally settle. Conflicts over land arose. Often slow to move in, the cattle companies discovered settlers on company land when they arrived. Measures, often violent, were taken to evict these settlers.

The biggest land rush of all was to Rondônia. Because the state was only sparsely populated in the mid-1960s, the government had an excellent

chance to settle it in an orderly fashion. Large colonization projects were established, but they were too successful. Peasants and land speculators poured in, especially from southern Brazil. By the end of 1983, about 50,000 families, or 350,000 people, had been settled in 25 colonization projects on tracts of about 100 hectares (250 acres) per family. By early 1984, an additional 30,000 families had arrived and were waiting for land. Without much planning, another 2.5 million hectares (6.2 million acres) were assigned as "quick settlement" colonization projects. People who did not get land in Rondônia subsequently moved further west and north into Acre and Amazonas. Many families simply occupied any vacant land they could find — land that often was claimed by cattle companies.

### Unsustainable development.

Much of the land is not farmed properly. Migrants arrive with little understanding of the ecology of the Amazon. They cut down the forest indiscriminately, eroding the land and depleting the soil of nutrients. The misuse stems not only from ignorance but also from the settlers' precarious economic situation. They act with an eye to increasing the market value of their land so that they can make as much money as possible if the farms fail and they are forced to sell. Instead of fertilizing exhausted cropland, they plant it in grass and clear more forest. Gasoline for chain saws is cheaper than fertilizer. Even if the depleted land becomes very rough pasture mixed with secondary growth, settlers can obtain a higher price if the land has been cleared. The 1965 prohibition

in the Forest Code against clearing more than 50 percent of a forested tract is routinely ignored and almost never enforced.

The big cattle companies also engage in unsustainable agricultural activities. They clear large areas, plant pastures, and then often ruin them by overgrazing, nonuse of fertilizers, and overuse of herbicides that kill not only weeds but also legumes that could increase soil nitrogen naturally. As the flow of money from tax rebates came to an end, many of the cattle ranchers sought other uses for their vast tracts of land. Some ranchers established colonization projects and sold off tracts of land to settlers.

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## Gasoline for chain saws is cheaper than fertilizer.

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In the late 1970s, the government became increasingly aware that the cattle companies would continue to operate at a loss and, worse still, that irreversible ecological damage would be caused in the Amazon if more ranching projects were encouraged. The government looked to another sector to spearhead development: mining. Cattle raising and colonization now were viewed as secondary activities, subordinate to big mining projects.

In this manner, the government began to promote in the Amazon the same model for economic development that was used in the industrial south. Investment was concentrated in a few major projects, such as a huge steel mill or hydroelectric dam. To cover part of the cost, foreign borrowing was encouraged because the government thought that export earnings from the projects could be used to repay the loans. Investment in public education, health services, and other "nonproductive" activities was held to a minimum. Unfortunately, both in the south and in the Amazon, the trickle-down process did not work well, and disparities in income grew.

**Turning point?** During 1987 and 1988, a number of events occurred that are influencing development in the Amazon: a Constituent Assembly was established in 1987 to draft the new, environmentally sensitive Brazilian Constitution of 1988; environmental organizations in the United States and Europe — directly and through their national governments — successfully pressured the World Bank and the Inter-American Development Bank to withhold loan funds from environmentally destructive projects; an unprecedented number of fires were set in the Amazon to clear land for farms and pastures; and Francisco "Chico" Mendez, leader of the Brazilian rubber tappers' union, was assassinated after having appeared before the United States Congress to protest destruction of the Amazon forest. His assassination was widely publicized.

In October 1988, faced with more frequent warnings from scientists and the threat of losing international loan funds, President José Sarney acknowledged, "Fires, deforestation, huge

agricultural projects, gold mines, and predatory development are destroying our flora and fauna." He announced a series of provisional steps aimed at slowing destruction in the Amazon. Of these, the most important was the suspension of tax rebates and other official incentives for cattle ranchers. He also announced a prohibition on the export of large logs to slow lumbering in the Amazon and ordered studies to determine which areas should be opened for agriculture or cattle and which areas should be designated for permanent preservation.

**New constitution.** At this point, some references to the 1988 Constitution are in order. Article 225, "Concerning the Environment," states that everyone has a right to an environment in ecological equilibrium. To secure this right, the government must

- "preserve and restore essential ecological processes and provide ecologic management of species and ecosystems,"
- "preserve the diversity and integrity of the genetic patrimony of the



Photograph by Alberto Nêto

Children in Petropolis, Brazil. The needs and increasing aspirations of expanding numbers of people have forced changes in land usage and imposed excessive demands on natural resources.

country," and

• "define ... territorial spaces ... to be specially protected."

The Amazon forest is expressly declared to be a "national patrimony," whose use is subject to environmental restrictions. Article 231 recognizes special rights of Indians over lands that they "traditionally occupy" and directs the national government to demarcate and protect such lands for the benefit of the Indians. The lands are declared to be inalienable and not subject to any claims by non-Indians who may occupy or use them unlawfully.

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The Amazon forest is expressly declared to be a "national patrimony," whose use is subject to environmental restrictions.

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Articles 184-191 concern agricultural policy and agrarian reform. Articles 184 and 185 provide that the federal government may expropriate for redistribution to small-scale farmers only "unproductive" rural land that is not meeting its "social function." Article 191 states that a person who, for five uninterrupted years, is in possession "without opposition" of a rural tract not larger than 50 hectares and makes it productive by his labor and that of his family, can acquire ownership unless the land is public. A person can obtain ownership of public land only by an express grant from the government. In the case of colonization projects on public land, settlers usually are required to take possession and make the land productive by raising crops or cattle before receiving their grants.

"Our Nature." In April 1989, President Sarney announced a US\$100 million, five-year program to divide the Amazon basin into zones for economic and ecological uses. Entitled "Our Nature" and financed in part by the United Nations Food and Agricultural Organization (FAO), the program

is designed to facilitate the rational assignment of economic activities to specific areas and the environmental monitoring of these activities.

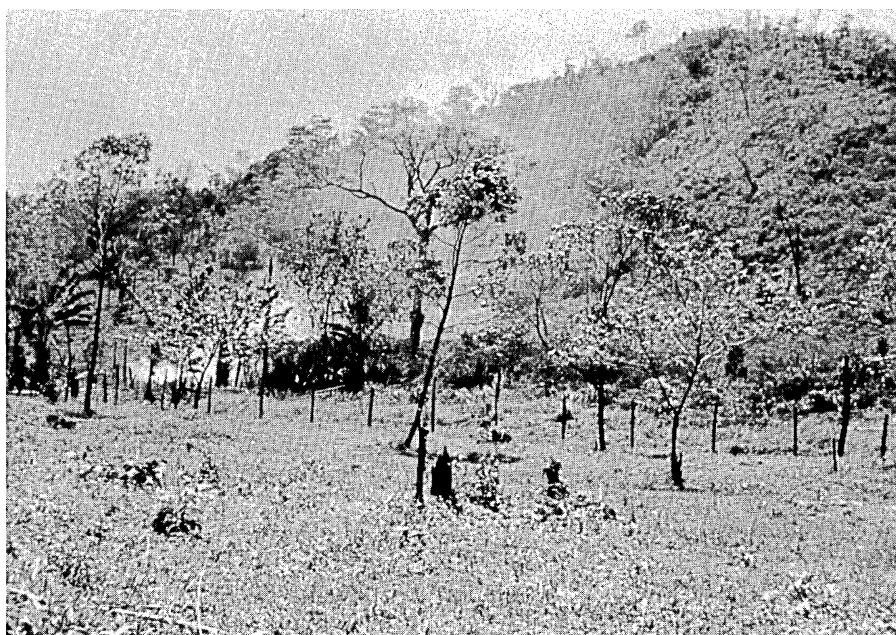
As part of the program, Sarney signed forty-nine legal decrees. One of them continues the 1988 suspension of tax rebates and official credits for cattle ranches in the Amazon. Another restricts cutting and requires reforestation by lumber and paper companies and by ceramic and metal producers that use wood or charcoal for fuel. Two other decrees regulate mining practices and the production and sale of metallic mercury, which is used to separate gold from ore and pollutes Amazonian rivers. Still others create new parks and reserves and provide for public investments in new environmental programs and for the creation of a National Environmental Fund capable of receiving and distributing donations from Brazilian, foreign, and international institutions.

A few days after Sarney's announcement of "Our Nature," it was reported that the World Bank soon would approve up to US\$300 million in loans to spur Brazilian rural development outside the Amazon region, hoping to relieve pressure on the Amazon. It now appears that agriculture would be more successful and profitable in the central savanna of Brazil than in the Amazon itself.

### Strategies for the future.

What should be done at this stage to help conserve the Amazon forest?

Managing renewable resources. One step advocated by rubber tappers, scientists, and environmental organizations is to create vast "extractive reserves." These areas could be exploited economically by harvesting rubber, Brazil nuts, and other forest products in ways that preserve the forest. Research is under way on how to increase the number of rubber trees — from the natural average of five trees per hectare to as many as thirty per hectare — without disturbing the forest ecology. The World Bank and Inter-American Development Bank are supporting this concept. With their



Photograph by Sandra Brown

The causes of deforestation are inseparable from the major problems of developing countries. Population pressures, poverty, and inequities in land tenure all lead to clearing new land. Pressure to generate foreign exchange for debt payments is seen as justification for mining the forests and converting forested land to cash crops and cattle ranches. In many cases, government subsidies stimulate forest destruction at public expense.

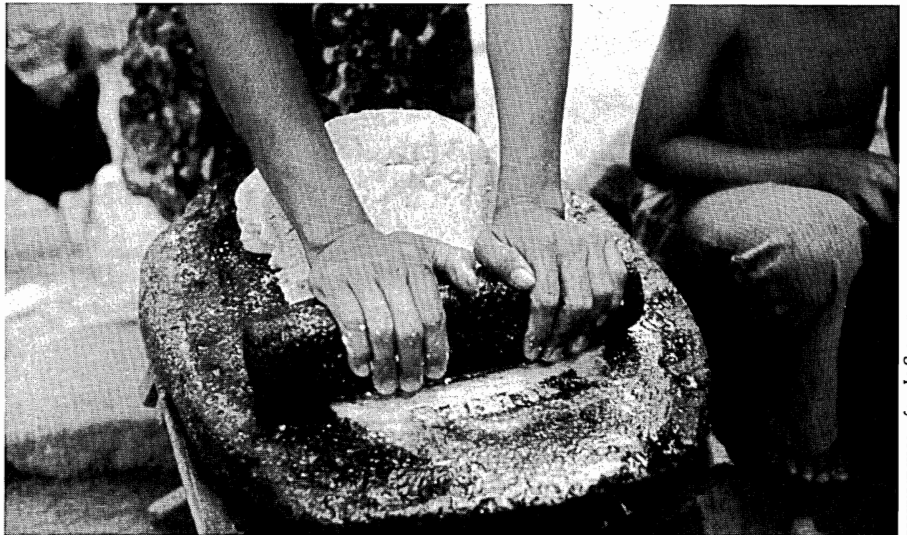
support, the Brazilian government began creating twelve reserves — totaling roughly the area of New Jersey — even before the “Our Nature” program was announced.

It also appears that extracting rubber, nuts, and other products from the intact forest may be more lucrative in the long run than large-scale cattle ranching on cleared forestland. Studies have shown that the 500,000 rubber tappers in the Brazilian Amazon now earn, on the average, 50 percent more than small-scale farmers who clear the forest.

**Limiting new development.** New economic development projects in the Amazon should not be approved unless they comply with the National Environmental Policy Law of 1981. This law requires studies of the environmental impact of proposed public and private development projects and of all technological alternatives to such projects. In addition, environmental impact studies must examine the geographic limits of the projects and of their effects and possible mitigation measures.

All studies are to be conducted by multidisciplinary teams not dependent directly or indirectly on the proponents of the projects. Without favorable environmental studies, the government should not permit the construction of new roads into presently inaccessible areas; mining, manufacturing, or hydroelectric projects; widespread clearing for new farms or ranches; or other major developmental activities. Nor should international development banks finance these activities.

New migration of landless peasants to the Amazon should be discouraged. The government should refrain from building more roads in the Amazon and should undertake agrarian reform in areas outside the Amazon where fertile land is concentrated in large, unproductive holdings. In the country as a whole, 2 percent of the land-owners control 60 percent of the arable land; 70 percent of rural households own either no land or less than can support a family.



Photograph by Karen L. Russon

The world's population is increasing by nearly 90 million people a year. Most of this growth occurs in developing countries, where many people already suffer from inadequate food supplies. Today, the challenge is to increase agricultural production to meet this unprecedented increase in demand while preserving the natural resource base.

**Establishing sustainable agriculture.** Small-scale farmers already in the Amazon should be provided credit and technical assistance to enable them to minimize the amount of forest cleared. It is possible to plant coffee, cacao, black pepper, Brazil nuts, and other perennial crops that provide higher incomes on a single piece of land. Farmers initially might clear a larger area for planting, but over twenty years they would destroy much less forest. They could rotate subsistence crops annually among tracts occupying most of the holding while maintaining perennial crops on a single plot for about ten years until the soil gives out. Proper use of lime and fertilizers could substantially increase the length of time during which cleared land would provide economic yields.

**Swapping debt for nature.** “Debt for nature” swaps should be used to protect forestlands in exchange for the discounting or forgiveness of portions of Brazil's US\$110 billion foreign debt. For example, dollar loans could be forgiven on the condition either that the government create extractive reserves or that debtor institutions contribute local currency to the National Environmental Fund, which was established under the “Our Nature” program.

**Restricting loans.** Loans from international development banks should be subject to environmental protection conditions, and loan funds should be withheld where the conditions are violated. Although such conditions are criticized by the Brazilian government as “foreign intervention” in the nation's sovereign affairs, Brazil's need for development loans is a key pressure point for influencing its public policy concerning the environment generally and the Amazon forest in particular.

The new president of Brazil, Fernando Collor de Mello, who will take office in March 1990, has indicated that he favors stronger measures to protect his country's environment, including debt-for-nature swaps. ■

*Roger W. Findley is professor and acting dean, College of Law, University of Illinois at Urbana-Champaign. He has conducted comparative research on environmental protection and property law in Brazil and Colombia for twenty years. In 1988, Dr. Findley was a visiting professor at the Catholic University of Rio de Janeiro, Brazil.*

*Much of the historical background in the first half of this article comes from S. Branford and O. Glock. The Last Frontier: Fighting Over Land in the Amazon. Zed Books Ltd., London, 1985.*

# INTERNATIONAL AGRICULTURE

Update

UNIVERSITY OF ILLINOIS  
AT URBANA-CHAMPAIGN

COLLEGE OF AGRICULTURE

1990 Vol. 5, No. 2

## Universities and International Development: Past, Present, and Future

As UIUC enters its fifth decade of participation in the arena of international development, it is worthwhile to step back and look at what we have done, what we have learned, and, based on our past experience, what the future may offer.

It is our distinct pleasure to present articles by Orville G.

Bentley, former assistant secretary for science and education, USDA; Eldon L. Johnson, vice president emeritus of the University of Illinois at Urbana-Champaign (UIUC); and Thomas A. McCowen, associate director of the Office of International Agriculture, UIUC, and William N. Thompson, former director of the Office of International Agriculture at UIUC. I hope that their comments will be as enlightening to our readers as they have been to me. ■

*John J. Nicholaides III  
Director, Associate  
Dean, and Assistant  
Vice-Chancellor  
for Research*

## Some Reflections on the Development of International Programs in the College of Agriculture, University of Illinois at Urbana-Champaign

Orville G. Bentley

Following World War II, changing perceptions of the international responsibilities of the United States had a profound effect on the activities of agricultural colleges and their teaching, research, and extension programs. In the late 1940s, we were an affluent country, our government was stable,

and the entrepreneurial spirit of the people suggested that less developed and war-torn nations could turn to us for help.

There was a confluence of ideas, too. As a nation, we were sensitized to the humanitarian needs of people caused not only by the devastation of a costly and deadly war but also by the age-old problems of humanity: malnutrition and starvation, lack of health care, and the effects that deprivation, poverty, and lack of education have on the quality of life for millions of people.

**Technical assistance.** These humanitarian concerns and the challenge of our expanded role in international affairs were captured in President Truman's 1949 "Point 4" speech. He recommended that the centerpiece of U.S. foreign aid should be technical assistance — sharing our expertise in technology, science, and education — to improve the well-being of people and to foster peace and understanding among nations.

This commitment was far-reaching in that the President, in a sense, committed the resources of universities, government agencies, industry, and philanthropic organizations to carry out a major national policy. Response was enthusiastic from all sectors and led to a significant change in views on the relevance of world agriculture to the future of the U.S. system. Colleges of



Photograph by Michael E. Irwin

Bringing home the harvest in Indonesia. The goal of our international agricultural development activities over the past 40 years has been to eliminate hunger and poverty. Agriculture is the largest sector in the economies of most developing countries. By contributing to the development of agricultural universities, we can improve the welfare of people in developing countries and promote world peace and stability.

agriculture were the obvious institutions to develop an educational and research system aimed at increasing worldwide food production and modernizing agricultural production systems.

**Role of universities.** Across the nation, universities were challenged to expand their international programs by increasing foreign student enrollment, especially at the graduate-degree level, and by offering new research opportunities abroad. To the credit of the University of Illinois at Urbana-Champaign (UIUC), its College of Agriculture took an active role; it helped shape technical assistance programs at the national level and helped foster understanding and international literacy on campus and around the state.

Expanded international roles led to the need to explore new organizational and administrative arrangements for cooperative efforts with development agencies and other universities. Again UIUC took the initiative, along with Indiana University, Michigan State University, the University of Wisconsin, and the Ford Foundation, to create the Midwest Universities Consortium for International Activities (MUCIA). Joined later by Ohio State University, Purdue University, the University of Iowa, and the University of Minnesota, MUCIA brought new and innovative opportunities to the faculty members of its constituent universities and has continued that role for twenty-five years.

The national government was clearly committed to international development, and member institutions of the National Association of State Universities and Land-Grant Colleges (NASULGC) had committed themselves to help the government carry out these programs. But questions remained in the minds of some faculty members, leading to debates about the validity of participating in federally funded, technical-assistance programs overseas and about internalizing the international dimension into the research, teaching, and extension programs of colleges of agriculture. Another question was the place of international programs in the university: were overseas programs

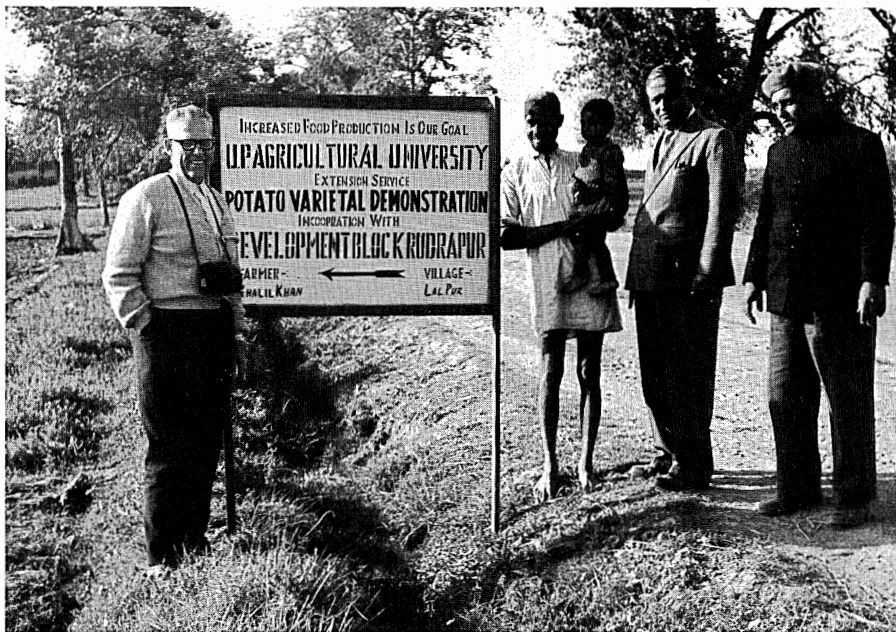
basically public service rather than academic functions? Faculty members scrutinized the institutional capability of universities to deliver technical assistance to countries that had different governments, different economic and social orders, and for which there were complicated and costly logistical requirements. Participation also raised questions about how programs should be implemented.

**Role of administration and faculty.** UIUC's College of Agriculture made two major decisions that helped set the policies for its involvement in international programs.

**Associate deanship.** The first decision came in 1966 with the appointment of an associate dean and director for international programs in the College of Agriculture. This action formally recognized the College's international commitment and facilitated operational details for involvement in international programs. Administratively and structurally, the appointment placed international activities in a position comparable to the teaching, research, and extension responsibilities of the College and of the faculty. Illinois was a leader in a trend that now has been widely adopted across the country.

Creating the new international administrative structure within the College still left the question of how international activities would fit into the College's basic missions of serving its diverse clientele — the people of Illinois and our nation — through teaching, research, and extension. The source of funds for international work also had to be determined. The College of Agriculture had traditionally received some of its budget for research and extension activities from the U. S. Department of Agriculture. Now funds were introduced from another agency, the U. S. Agency for International Development and its predecessors. This agency was interested in developing agriculture to meet the educational, research, and extension needs of people in far-off countries.

For faculty members, these changes raised questions about promotion, tenure, salary, and the academic "pecking order," to name a few. On December 7, 1966, the dean issued a memorandum that stated, in part, "Department heads and associate deans have the same responsibilities for programs of their staff members serving overseas as they have for staff members on campus." The dean's memorandum recognized that meeting the responsibilities for overseas



During a trip to India in January 1967, Orville G. Bentley (far left), then dean of the College of Agriculture at UIUC, visited one of the potato demonstration fields in Rudrajur Block. With him are (left to right) farmer Khalil Khan and daughter; N. K. Anant Rao, dean of the College of Agriculture, Uttar Pradesh Agricultural University; and extension agronomist S. S. Singh.

Photograph by Edwin Bay

staff was likely to be more complex than it would be for people serving on the faculty at the home campus. Department heads and directors were urged to familiarize themselves with activities of overseas staff members and, if necessary, visit overseas program sites to get information firsthand.

The memorandum of December 1966 then addressed the question of feedback from overseas activities. "This is perhaps the most difficult and important problem we face. However, the problem seems to be no different in kind from those normally found in the coordination of programs within and among departments." An important suggestion was that our USAID-funded contracts and other international agricultural programs should receive the same attention as our traditional programs in teaching, research, and extension.

**Faculty role.** The other major decision was to encourage greater faculty involvement in helping to define the nature of international programs in the College. By the late 1960s, the UIUC College of Agriculture and other U.S. colleges of agriculture were discussing their involvement in international activities.

The College did as most college faculties do with an issue of this type: it appointed a college-wide faculty committee to review some of the issues and make recommendations back to the faculty and dean. In 1970, the Odell committee concluded that the international dimension was essential to the future of the College of Agriculture. The committee recommended that international program activities be integrated into ongoing responsibilities on a department-by-department basis. This recommendation meant that the college structure would provide overall guidance and leadership in coordinating affairs in the international arena, but that recruitment of faculty members, development of feedback mechanisms, and possible involvement of students in international research programs would be linked, insofar as possible, to the research, teaching, and extension program activities of college departments.

Perhaps the following sentence from a section entitled "Philosophy and Development of International Programs" in the Odell report contained its most far-reaching recommendation: "A goal of the University of Illinois College of Agriculture is to continue an active program in international agriculture and to make its program more effective by building on the experience and expertise that had been developed over the years."

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## Colleges of agriculture are still struggling to increase understanding of the global dimensions of agricultural science and education.

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**Changes.** By the 1970s, education and research in international agriculture had matured. The earlier overseas programs in technical assistance and institution building were replaced by more internally based activities. Institutional linkages, joint research, and extension and teaching programs with international organizations and foreign institutions were developed, some with the institutions originally assisted under USAID-sponsored programs. Colleges began to give more attention to the subject-matter content of the international dimensions of agriculture and its relationship to the continuing development of our own food and fiber systems.

In UIUC's College of Agriculture, an example of efforts to focus on inherent strengths was the creation in 1973 of a miniconsortium on production and use of soybeans. The International Soybean Program (INTSOY) soon attracted worldwide attention, in part derived from the quality and diversity of the resource base on which the program was built.

The discussion continued on how to balance international and domestic responsibilities. The Title XII amendment to USAID's basic legal authorization and other legislation placed new

emphasis on the university-based role of international program activities. UIUC's College of Agriculture established the International Agriculture Policy Committee, a faculty committee interested in reassessing faculty attitudes and opinions on international activities. After study, the committee concluded in 1977 that current international activities were consistent with the recommendations presented to the faculty and staff in 1970 by the Odell committee.

**Need continues.** As in many academic issues, there is room for difference of opinion. Colleges of agriculture are still struggling to increase understanding of the global dimensions of agricultural science and education. The position of these colleges relative to international programming has been complicated by shifts in national policies on support for technical assistance and other foreign-directed educational and research activities.

Moreover, the international situation has changed. Many countries devastated during World War II now conduct sophisticated research and problem-solving activities in agriculture and industry. The sophistication of science throughout the world has changed markedly. Technological innovations in agriculture have been applied widely, leading to changes in production patterns that were not anticipated in the early 1950s.

This change has meant that leaders in international agricultural programming have had to rethink their roles and how colleges of agriculture might best participate in this important program area in the 1990s. The United States is no longer the only actor in the development of agricultural science and technology; in fact, there is a world community of leadership in agricultural sciences. Increasingly, we are discussing international competitiveness and our position in world markets and trade.

After forty years, we continue to debate the best ways to help solve those age-old problems of hunger, poverty, lack of education, and the need to improve the quality of life for millions of people. Much still remains to be done.

It is important that the experience and the sometimes slow and painful growth of the past four decades not be lost, but rather that they be used to help build a philosophy consistent with U.S. concerns and the world's agricultural and food problems.

For the sake of our national interest, the vitality, future growth, and development of U.S. agriculture must involve interaction with other nations as they work on environmental programs, pollution, and other issues in which the United States has an interest. The challenge remains: how to mobilize human resources to solve problems that are of such fundamental importance to humans — food, shelter, and good nutrition. ■

*Orville G. Bentley served as assistant secretary for science and education, United States Department of Agriculture, from 1982 to 1989. For 17 years, from 1965 to 1982, he was dean of the College of Agriculture, UIUC. Other positions include dean of agriculture and biological sciences and director of the agricultural experiment station, South Dakota State University, Brookings, from 1958 to 1965, and professor of ruminant nutrition at the Ohio Agricultural Experiment Station, Wooster, from 1950 to 1958. Dr. Bentley has served on national and international study panels and was appointed by President Gerald Ford to a three-year term (1976 to 1979) on the Board for International Food and Agricultural Development (BIFAD). Dr. Bentley currently serves as senior advisor to the director of the Office of International Agriculture, College of Agriculture, UIUC.*



The first African meeting of the Provisional Council, University of Nigeria, Engugu, Nigeria, 1960. Left to right: Nnamdi Azikiwe, premier, eastern region of Nigeria, and chair of the Provisional Council (later the first president of the Republic of Nigeria); Eldon L. Johnson, then president of the University of New Hampshire; the Minister of Education, eastern region; and John (later Lord) Fulton, then vice-chancellor of the University of Sussex.

## The University as a Developmental Resource

Eldon L. Johnson

**I**f mobilization of resources is the key to the development of the poorer countries, then the great resources built into the new universities must be used more effectively. After "institution building" should come "institution using," a badly neglected need.

**History.** A little history tells the story. As the European empires were breaking up after World War II, the newly independent nations — the former colonies — rushed to establish new universities, usually with the aid of international donors engaged in what they called institution building. These combined efforts yielded spectacular gains in many countries.

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The consensus is that developmental capacities of these universities too often lie mostly dormant and untapped.

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The first goal was to train the necessary high-level personnel — a teaching function. Passing on old

knowledge, however, was not enough: new knowledge, derived from research relevant to the country's problems, was needed. Otherwise, nothing deserving the name of development could occur.

Hence, the new universities sent their staff abroad for advanced degrees in the world's best universities, upgrading the new faculty recruits and replacing the imported professors. They built libraries and laboratories, they demonstrated new technology on university farms, and they prepared to serve the public in solving practical problems.

With surprising speed, impressive concentrations of highly trained brainpower emerged in the new universities. Often in the smaller nations, the single national university had more Ph.D.s on its faculty than could be found in all other public and private organizations combined. Coupled with repositories of existing knowledge and research facilities for new discoveries, which often were better than anything else in the country, the faculty competencies soon offered the intellectual independence essential for political independence and modern development.



**Unused resources.** However, the capable individuals in these universities have not been put to the best service in developing their countries. This phenomenon has been observed and lamented repeatedly in worldwide evaluative studies of many universities that are now reaching maturity after two or more decades of assistance from foreign donors. These studies include retrospective appraisals by the World Bank, the U.S. Agency for International Development, and the Food and Agriculture Organization of the United Nations. The consensus is that developmental capacities of these universities too often lie mostly dormant and untapped.

The reasons are clear enough — insufficient cooperation but with sufficient blame to be shared by both the universities and the governments. Governments were there first, before the university, usually with ongoing responsibility for such nonteaching functions as research and extension. There is understandable reluctance to give up or in any way weaken this historic mission. Even in teaching or personnel preparation, government ministries often had their own training agencies antedating the university's, which then was seen as competitive. Keeping control became a strong motivation and hiring its own new staff easier and safer for government than turning to professors who were viewed as elitist and impractical anyway. That is, they have been seen as so devoted to a long-term theoretical perspective that they could only thwart government's immediate or short-term needs.

On the university's side, its professorial culture admittedly has favored objectivity or neutrality and thus had feared political and any other involvement that might jeopardize autonomy, either individual or institutional. Usually, the application of knowledge is given a lower priority than its generation. The immediate and often only concern is the student in the classroom, not the adult in society. These academic predispositions and fears are aided and abetted by the attitude that "it is government's job, not ours."

Therefore, the chasm persists without bridges.

**Linkages Overdue.** Without changing the existing organizational order, on which much hope and energy are needlessly expended, extremely useful linkages are possible and overdue. They can range from the informal to such formal arrangements as liaison offices or memoranda of understanding on explicit divisions of labor, shared responsibilities, personnel exchanges, and joint projects. Governmental contracts and grants are mutually advantageous to both parties and assure the enlistment of professorial talents. The university's advisory capacities can be harnessed in a variety of ways: joint appointments, the secondment of university staff to governmental assignments, and the appointment of university faculty members to top government policy-making bodies.

Encouraging examples exist. In Taiwan, government and farmers' associations do extension tasks, but eighteen university professors are co-opted for half-time service as invaluable subject-matter specialists. In Indonesia, a university was given the developmental planning task for a province — an entire large island — as a way to harness high-powered interdisciplinary resources without fear of duplication or change of overall organizational missions. In India and Pakistan, universities have been given technology transfer or extension functions for a cluster of villages or for an entire state. Without battles over turf or mission, the arrangement was mutually beneficial to the cooperating parties, and no gain was felt by one at the expense of the other. In some cases, governments have built or relocated agricultural research facilities adjacent to the agricultural university, specifically to encourage collaboration.

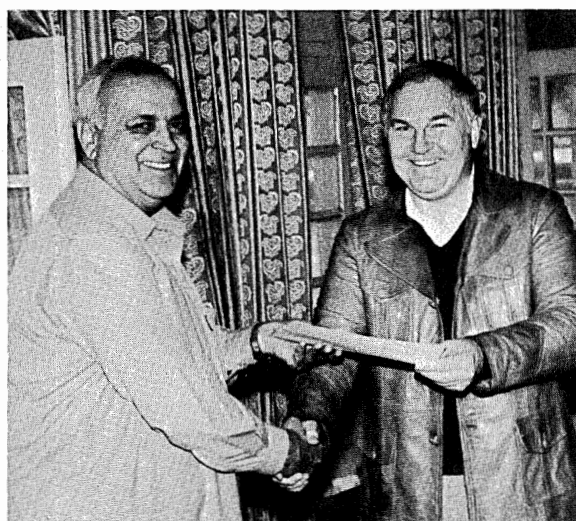
The linkage sought should, of course, serve the government without putting in jeopardy the university's capacity to perform the intellectual mission expected of it. That is the test of balanced autonomy. Except for the totally planned societies, the justified

complaint of universities is that they do not have the opportunity to cooperate, not that their services are enlisted to the point of engulfment. There is, however, the atypical case of the British professor who, years ago, taught in a Southeast Asian university and returned to write about how the university's expected functions were jeopardized by governmental demands on personnel, including everything up to ambassadorial appointments and onerous imposed assignments.

**Mutual Advantage.** It can be argued that the substantial investment in institution building around the world cannot be justified if its benefits go only to the fortunate few in the classroom while neglecting the broader public and its problems. The university should welcome and seek out public service as an indispensable component in its mission and as the price for public support. The government, from its dominant position, should welcome and seek out the concentrated professional talents of the university in the confident assurance that they can be immensely useful "on tap but not on top." ■

*Now retired after eleven years as vice president of the University of Illinois, Eldon L. Johnson is currently senior adviser to the International Program for Agricultural Knowledge Systems (INTERPAKS). Previous positions include president of the University of New Hampshire and president of the Great Lakes Colleges Association. Dr. Johnson has been a consultant for both governments and foundations and has written extensively on the evolution of U.S. public universities and on interinstitutional cooperation both at home and abroad. He served as U.S. representative on the governing councils of new universities in Kenya, Malawi, and Nigeria and on special educational missions in Botswana, Egypt, Lesotho, Nigeria, South Africa, Sudan, Swaziland, Taiwan, and Tunisia. Dr. Johnson also served for eleven years on the Board of Directors of the Midwest Universities Consortium for International Activities (MUCIA).*

A part of any institutional development project is recognizing the advancements of participant trainees. Here, Thomas A. McCowen presents a certificate to Mohammad Karim, dean of the Faculty of Agriculture, during a ceremony at the Northwest Frontier Province Agricultural University, Peshawar, Pakistan.



## Development of Educational Institutions — Lessons Learned

Thomas A. McCowen and William N. Thompson

**D**uring the 1990s, the University of Illinois at Urbana-Champaign (UIUC) will enter its fifth decade of participation in our nation's foreign assistance programs. In 1952, the National Association of State Universities and Land-Grant Colleges (NASULGC), on behalf of its members, responded to President Truman's 1949 inaugural address, in which he called for bold new programs of technical assistance for the developing world.

Commencing with a program of modest assistance at the Allahabad Agricultural Institute in India, UIUC has continuously been involved in programs or projects throughout the developing world. Additionally, the University has supported the development of educational institutions in scores of countries by educating foreign students, primarily at the graduate-degree level.

The U.S. government has been the primary financial supporter of these programs through the U.S. Agency for International Development (AID) and its predecessor organizations. In addition, the United Nations Development Program (UNDP), the Food and Agriculture Organization (FAO), and other organizations have supported programs.

**Institution building.** Many people associate institution building with a university-to-university link. When we use the phrase institution building, we are referring to institutions in a broader sense. Institutions take many other forms — research organizations, extension services, cooperative societies, markets, and so on. All are examples of institutions, and most have elements that lend themselves to institution building.

The foreign research and educational organizations with which UIUC has been associated have embodied one or more of the three functions — teaching, research, and extension — of land grant universities. We have been involved with multifunctional agricultural universities in India, Kenya, Nepal, Pakistan, and Sierra Leone. Some were newly established, others had existed for a long time but needed changes to be effective in agricultural development. All had teaching as a major function and shared research and extension functions with other provincial, state, or national organizations. Our cooperative programs in Belize, Ecuador, Jamaica, Jordan, Malawi, Mexico, and Taiwan concentrated on national extension systems. Still other programs in Colombia,

Peru, Sri Lanka, Taiwan, and Zambia focused on research in national and international organizations.

Despite this broad array of activities, in the minds of many, UIUC is associated with university institution building because of its successful record of developing multifunctional agricultural universities with funding from AID. Within this context, we consider "lessons learned" and draw implications for continued activity by UIUC.

**Lessons learned.** In the 1950s, 1960s, and early 1970s, AID primarily supported technical assistance projects to develop educational and research institutions in agriculture and related fields. Following a hiatus of several years, in the mid-1980s, institutional development reappeared as one of the "four pillars" of AID's assistance programs but without, however, a comparable level of support. Studies and observations of AID-supported agricultural universities, including those in which UIUC participated, have yielded a number of useful lessons for designing and implementing future projects.

Objective is development. Agricultural universities should be oriented to development. The primary goal should be to increase production and income and to improve the welfare of farm families. Also important are increasing the productivity of the entire agricultural sector, enhancing the national supply of food and fiber, and adding to agriculture's contribution as an earner of foreign exchange.

Research linked to extension. The university must have both a strong research program and effective links to the extension system. In a university, faculty research is essential for a strong teaching program, particularly at the graduate level. Ties to extension transfer results of this research to farmers and other clients. These same ties inform faculty members and students of problems that need to be studied.

Coordinated efforts. University, state, and national research and extension work must be coordinated.

The U.S. land grant model has confirmed that teaching, research, and extension programs complement each other. Given the existing division of responsibilities for teaching, research, and extension in a number of developing countries, emphasis should be on function, not structural form, in applying lessons from the United States and other countries that follow the land grant model.

**Reorganization necessary.** University administrative structure must be consistent with function. Changes in functions and goals, which occur when traditional teaching institutions are asked to assume a broader range of responsibilities in order to relate to an expanded array of clients, require changes in the organization of these institutions.

**Role of leadership.** Leadership is critical and has been demonstrated to be the most important single determinant of success in institutional development. Enlightened leadership is particularly important at the level of chief administrative officer. It is also important at intermediate administrative levels and among faculty members and students.

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## Developing educational institutions takes time.

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**Government support.** Continuing commitment of government to the goals of the university during and following its early development is essential. Most agricultural universities in developing countries are governmental or quasi-governmental organizations. Successful university development projects require the understanding and willingness of key governmental bodies to support the university as an investment that will improve production and the welfare of those in the agricultural sector and society in general.

**Goals clarified.** Agreement and cooperation are essential among host country, donor organization, and technical-assistance support organizations

on the university's development goals and strategies. Participation in project planning, implementation, and joint ongoing review and evaluation foster understanding and agreement on goals and strategies.

**Good planning needed.** Thorough joint planning for university development is crucial. Intensive involvement of university leaders, faculty members, and a team experienced in university development is required to develop consensus on the needs for changed missions, programs, administrative structures and procedures, resources, and leadership. This interaction is necessary to attain the understanding and commitment essential to the long-range development of the university to a level of sustainability without external assistance.

**Appropriate assistance.** The level of technical assistance and the manner in which it is delivered should be planned and programmed. Technical assistance should complement resources of the host country and should be scheduled in a timely manner to develop an indigenous institution. It is a mistake to think that a successful U.S. university can be transplanted to, or successfully duplicated in, another country.

**Project input mix.** Technical assistance inputs should be balanced. The levels of staff development, expatriate personnel, facilities, and equipment must be carefully balanced with host country resources throughout the life of the project. Faculty and staff development should be initiated early to achieve mid-project and longer term impact. Expatriate personnel are most effective in guiding the changed mission and structural alterations in the institution rather than in filling operational roles. Improvements in facilities and equipment are most effective when scheduled to complement the programs conducted by the upgraded personnel.

**No quick fix.** Developing educational institutions takes time. Experience confirms that ten or more years are required to make an agricultural university viable. This reality often is overlooked in the rush to demonstrate that project goals have been attained.

**Project phasing.** Universities tend to decline in effectiveness if donor assistance is withdrawn abruptly at the completion of a project. Three factors result in abrupt withdrawal: inadequate appreciation of the time required to transform traditional agricultural institutions into dynamic, client-centered, science-based institutions; poor phasing of host country and external resources in the latter years of the project; and inadequate provisions for maintaining links with international agricultural research and educational systems.

**Project performance.** Nearly four decades of experience in university development have revealed the following points<sup>1</sup> about the performance of U.S. universities in the technical assistance projects that were judged to be successful:

- project planning and review were better than average
- collaborating U.S. institutions were strong universities with a commitment from all administrative levels and faculty members
- members of university technical-assistance teams were well qualified, received orientation before going abroad, and adjusted well to cultural and living conditions in the host country
- expatriate teams were conditioned to the varied and subtle aspects of institutional development and did not limit contributions to operational assistance
- support from the home campus was timely and of high caliber
- technical-assistance personnel identified, worked at, and completed expected tasks before returning home.

Project performance by the host institution was enhanced when

- there was continuity of leadership in the operation of the project by the cooperating institutions

<sup>1</sup> Adapted from Baldwin, I. L., J. A. Rigney, R. W. Roskelley, and W. N. Thompson, *Building Institutions to Serve Agriculture*. Committee on Institutional Cooperation, Purdue University, 1968.

- staff development programs led to significant changes within host institutions, and provisions were made to use effectively the staff who received higher academic degrees or special training
- host nationals were open to new ideas in university mission and organization
- there were significant increases in students, graduates, graduate programs, research, or outreach activities
- changed attitudes and commitment of indigenous staff promoted institutional growth.

### Implications for the 1990s.

The lessons learned over the past 40 years are being applied by UIUC in current university development programs in Pakistan and Kenya. The application of these lessons, however, is not automatic. The concepts of institution development and their methods of attainment are under constant review and modification to accommodate to each situation. No two institution-development projects can be treated alike. Each has unique features, many of which become apparent only with the passage of time.

Donors and host governments alike, citing the history of support to agricultural institutions and the significant research on institution building since the 1970s, seem to expect that the process can somehow be compressed. This feeling was especially prevalent in the higher echelons of AID from the mid-1970s to the mid-1980s. Fortunately, there is some evidence that AID is reassessing that position, recognizing that the development of institutions is measured in decades rather than five-year increments, and is focusing on those elements of institutional development that promote sustainability.

Investments in the past have led to improvements in agricultural development in several developing countries. For many of the pioneer institutions, the infusion of external resources produced well-trained scientists who, by now, have reached the age of retirement. In many cases, retiring

staff will not be replaced with staff of comparable training. We should consider developing linkage programs, with appropriate resources, to facilitate collaborative research and retooling of faculty skills.

Also, in many countries, particularly in Africa, the award of a high-quality bachelor of science degree in agriculture is still a distant goal. Attempts to encourage regional agricultural universities have not met with particular success. U.S. institutions should be thinking about alternative delivery systems to bring science-based agriculture to the basic educational programs of these countries.

With four decades of experience, UIUC is well positioned to contribute significantly to this nation's foreign policy objectives as they relate to the development of institutions. UIUC has been able to modify, refine, and augment the knowledge gained from this experience in designing and implementing projects. Clearly, we have much to offer the developing world and, consistent with our past interest, development projects probably will be our primary direction.

Recent events in central and eastern Europe offer tremendous potential for development-oriented institutions, such as ours, to be involved in designing new delivery systems and in helping transform "command-centered" institutions into "demand-centered" institutions. The opportunities to apply the lessons learned to both traditional third-world clients and emerging second-world clients are an exciting prospect. Communicating the information that the transformation of institutions is mutually beneficial and is in the interest of global security is a task not just for national leaders but for us all.

New resources to meet the new challenges are required. The problems of the developing world will not be solved by redistributing the resource pie, although some redistribution should be possible. The challenge is real; the potential for improved global security is substantial. ■

*Thomas A. McCowen is associate director of the Office of International Agriculture and serves as campus coordinator for the College's international technical-assistance projects in Kenya, Pakistan, Rwanda, and Zambia. While director of overseas projects in the Office of International Programs and Studies at UIUC, he was campus coordinator for projects in India, Jordan, Sierra Leone, and Tunisia.*

*William N. Thompson is UIUC professor of agricultural economics and international agriculture, emeritus. In addition to a career of teaching and research in farm management, agricultural policy, and agricultural development, he led the UIUC team at Njala University College, Sierra Leone, and planned and evaluated institution-building projects in India, Lesotho, Nepal, Pakistan, and Thailand. Dr. Thompson also served as director of the International Soybean Program, director of International Agriculture, associate dean of the College of Agriculture, and UIUC assistant vice-chancellor for research.*

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# INTERNATIONAL AGRICULTURE

UNIVERSITY OF ILLINOIS  
AT URBANA-CHAMPAIGN

COLLEGE OF AGRICULTURE

Update

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## Opportunities for Mutual Understanding

I cannot help wondering whether the Gulf War would have occurred had people with Fulbright or Peace Corps experience in that part of the world been in key decision-making positions in the U.S. government and military. Perhaps even Saddam Hussein himself would have benefited from a better understanding of Western thought and reaction processes through a Fulbright experience. One cannot say. What is clear, however, is the truth that a better understanding of other peoples, cultures, mores, and languages can lessen the possibility of misunderstandings and even war.

Two of the best opportunities that foster better understanding are the Fulbright Program and the United States Peace Corps. To better acquaint our readers with these opportunities, we present guest articles by the founder of the Fulbright Program, Senator J. William Fulbright; the deputy director of the U.S. Peace Corps, Barbara Zartman; Fulbright scholar and University of Illinois professor of agricultural economics, John Braden; and former Peace Corps volunteers Pamela Woodard and Karen Russon, both international agricultural development specialists at the University of Illinois.

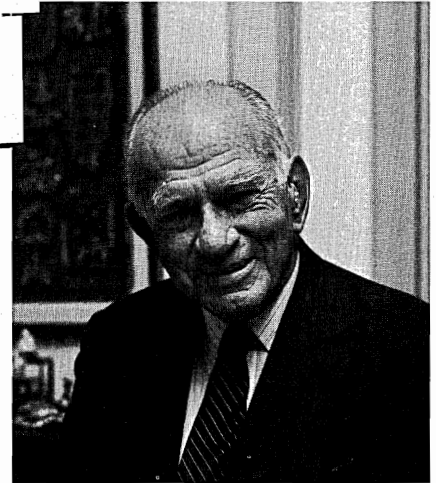
Peace Corps experience also has impacted the lives of many others in the College of Agriculture. For example, Gwynne and I served with the Peace Corps in Panama during the late 1960s. Burt Swanson, professor of agricultural communications and education and director of our International Program for Agricultural Knowledge Systems (INTERPAKS), was a volunteer with the first Peace Corps group in Cyprus. Among many other

former Peace Corps volunteers in the College are Phil Garcia, professor of agricultural economics, in Uruguay; Sam Johnson, associate professor of agricultural economics, in Malaysia; Danny Erickson, research associate with the International Soybean Program (INTSOY), in Nicaragua; Andy Sofranko, professor of rural sociology, in Nigeria; and David Thomas, associate professor of animal science, in Kenya. Each of them received his or her initial international experience with the Peace Corps, and today each continues to make positive contributions to society.

In September 1989, I was privileged to be one of two U.S. interviewers of the Fulbright candidates from Costa Rica, Ecuador, and Peru. What a superb group of young, talented people we interviewed in those countries. Many of them will be leaders in their own countries. Certainly their Fulbright experience will serve them and us well. In the College of Agriculture, our dean, W.R. Gomes, spent 1974 in Yugoslavia as a Fulbright-Hays Distinguished Traveling Professor with the College of Medicine at Zagreb University.

As the Peace Corps celebrates its 30th anniversary and the Fulbright Program celebrates its 45th anniversary, we present this issue of the *International Agriculture Update* with the hope that the continuation of improved opportunities for understanding afforded by these and other such programs will lead to a better chance for world peace and harmony. ■

John J. Nicholaides III, Director,  
Associate Dean and Assistant Vice  
Chancellor for Research.



For more than 40 years, Senator J. William Fulbright has led the effort to promote world harmony through educational exchanges. In recent years, the ideas behind this program have spread as models for building better understanding in nations all around the world.

## The Fulbright Educational Exchange Program: A Road to World Understanding

J. William Fulbright

Since a very modest beginning 45 years ago, some 180,000 men and women have participated in the international educational exchange program outlined in the Fulbright Act of 1946. Many of these men and women now occupy positions of importance and influence in their respective societies.

These people have acquired a capacity for empathy; they bring to their communities an understanding of

other countries, their customs, religions, and history. This understanding allows them to be more enlightened when making decisions affecting the relationship of their respective countries with other countries that have different traditions and cultures. In this era of strife and violence, people who can understand and can mitigate the passions that arise from the conflict of ideological convictions are essential if the community of nations is to find a way to adjust to the reality of the age of nuclear weapons.

It is not pretentious to believe that intercultural education and the exchange of students are more important to the survival of our country and of other countries than are the Strategic Defense Initiative and a redundancy of hydrogen bombs. Conflicts between nations are the result of deliberate decisions made by the leaders of those nations, and those decisions are influenced and determined by the experience and judgment of the leaders and their advisers. Therefore, our security and the peace of the world depend upon the character and intellect of the leaders rather than upon the weapons of destruction now accumulated in enormous and costly stockpiles.

### A worldwide model

The direct result of the exchange program is significant, but we should not overlook the fact that after the American program demonstrated the validity of the concept, other countries have themselves initiated their own government-supported exchanges, so there has been a proliferation of similar schemes. This is gratifying, but, in truth, the numbers pale into insignificance compared to the enormous expenditure of money and talent on military armaments. It is a critical question whether the truce between the United States and the Soviet Union will last long enough for the effect of intercultural exchange and other joint ventures to rise to the level of leadership in the two countries, as it has already done in some smaller countries.

The fundamental challenge in this nuclear high-tech era is one of

psychology and education in the field of human relations. It is not the kind of problem that is likely to be resolved by expertise, even the sophisticated expertise of our most gifted military thinkers, who delight in exotic weapons and strategic doctrines that threaten the solvency of the richest nations as well as their physical survival. The attributes upon which we must draw are the human attributes of compassion and common sense, of intellect and creative imagination, and of empathy and understanding between cultures.

The cultivation of these attributes is the highest calling of all true educators. ■

*J. William Fulbright currently is counsel with the law firm of Hogan and Hartson in Washington, D.C. He served more than 30 years as a United States Senator from Arkansas. For 15 of those years, he chaired the Senate Committee on Foreign Relations. In 1946, he introduced and procured enactment of the Fulbright Act authorizing the exchange of students and teachers between the United States and other countries. Later, he sponsored the Fulbright/Hays Act of 1961, which expanded and modernized the existing Fulbright Program.*

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## A Fulbright Scholar Looks at Perestroika 'Down Under': New Zealand's Economic Revitalization

John Braden

Little did I know in mid-1988 that a Fulbright research grant to New Zealand would give me a glimpse of Eastern Europe and the developing world. The Fulbright invitation was for an economist specializing in natural resource and environmental issues to spend six months in the Centre for Resource Management at the University of Canterbury. While the natural resources of New Zealand allow for interesting study, equally fascinating is the nation's ongoing economic experiment—an experiment that is both sobering and encouraging for the many other countries trying to shake loose from decades of centralized economic management.

### From top to bottom

In 1960, New Zealand was one of the richest developed countries. Its per capita income was 15 percent above the average for the 25 wealthiest nations that belong to the Organization of Economic Cooperation and Development (OECD). Just 25 years later, New Zealand ranked near the bottom of the OECD, with per capita income surpassing only that of Spain, Greece, Portugal, Turkey, and Yugoslavia.

Behind New Zealand's decline are two compelling stories. One is about



Erosion from overuse of marginal grazing land is just one of the problems that have plagued the New Zealand economy in recent years. With assistance from the Fulbright program, John Braden spent almost a year in New Zealand studying this and other natural resource issues with direct applications to the emerging democracies in Eastern Europe.

dramatic changes in the international economy. The other is about protectionism. Together, these stories vividly illustrate the importance and the pain of economic liberalization. Observing New Zealand's experience provides insight into the turmoil ahead for President Gorbachev's "perestroika" plan in the Soviet Union, Eastern Europe's adoption of market economics, and the World Bank's campaign to "get the prices right" in the borrower nations.

### A David among Goliaths

Just three million people inhabit the archipelago known as Aotearoa, the Land of the Long White Cloud to the Polynesian Maori people. There are almost 20 sheep and three cattle for each person in New Zealand. Agricultural products, especially animal products, have long been New Zealand's leading exports, and, hence, its chief source of the foreign exchange needed to buy the many products that it

must import. For example, in the middle 1960s, agricultural products accounted for over 90 percent of the value of all exports.

New Zealand prospered because of its productive pastoral agricultural system and because it enjoyed favorable trading relations, principally with Europe. The large European market could easily absorb the output of small New Zealand. Moreover, the decade after World War Two was a boom period for agricultural commodity producers. Fueled by Europe's reconstruction and the Korean War, commodity demand and prices were high. With its advanced agricultural technology and unscarred by war, New Zealand had a head start in supplying the boom.

As a David serving Goliaths, however, New Zealand was tremendously vulnerable to shifts in the agricultural needs and policies of its foreign clients. The needs began to diminish in the 1960s, when the European economies reached full recovery from the war. Many of the developed economies experienced very rapid growth. They and other middle-income countries experienced significant increases in agricultural productivity. While New Zealand continued to grow economically, its growth was slower because other countries were surpassing New Zealand's productivity.

To make matters worse, 1973 brought both Britain's decision to join the Common Market and the first oil embargo. Britain's move greatly reduced New Zealand's access to its main export market and increased the competitiveness of British agriculture. The oil embargo drastically increased New Zealand's import expenses.

### Protection from progress

The agricultural trade boom of the 1950s and 1960s had been accompanied by protectionist policies. Domestic producers received substantial government subsidies while import restrictions kept foreign competitors at bay. While the economic prosperity of the post-war period was rooted in the economics of world recovery, New Zealanders were inclined to look no further than the protectionist policies.

In the 1970s, declining economic fortunes could no longer be denied. The initial response was even greater protectionism: more subsidies for domestic producers and higher barriers to imports. The agricultural sector was a major recipient of production grants and input subsidies, tax incentives for land development and livestock assets, and concessionary loans.

When an international agricultural commodity boom produced very high prices from 1973 to 1975, New Zealand's encouragement of high agricultural throughput seemed like a good idea. New Zealanders briefly gained some lost ground relative to incomes elsewhere in the OECD.

But the boom was short-lived. When agricultural commodity prices tapered off after 1975, New Zealand's economy swooned. Productivity actually declined. From a position of no net overseas debt in 1974, over 80 percent of New Zealand's gross domestic product was mortgaged by overseas debt a decade later. Government borrowing pushed up interest rates, but inflation ranging over 15 percent per annum more than kept pace.

The negative real interest rates encouraged more borrowing and investment in inflation-resistant assets, particularly land. Farmland was especially favored because of the government subsidies to farming. Between 1972 and 1982, the inflation-adjusted price of farmland almost doubled.

By 1982, out of desperation about spiraling prices and declining productivity, the Government imposed a freeze on prices, wages, interest rates, and the nominal exchange rate. Born

out of economic imbalance, the freeze was no solution. Government and external debt continued to pile up. The problems driving New Zealand's economic decline were not of the cosmetic sort that could be solved with a time-out for fresh makeup. They were fundamental problems stemming from the failure to recognize and adjust to new realities in the international economy.

### Braving the new world

The root of New Zealand's problems was in protecting its industries from world market pressures for greater efficiency and new products. The domestic subsidies and import barriers removed the discipline of the market place. The possibility of failure is the ultimate economic motivator, but public policies essentially excluded failure. While those policies protected individuals and businesses, they slowly sapped the nation of its economic strength.

A new government, elected in 1984, undertook a program of liberalization. The design was to unleash the economy by removing distortionary domestic incentives and lowering trade barriers. Over the ensuing six years, much has been accomplished. A once moribund commercial sector has begun to show signs of modernization and liveliness.

New Zealand farm products now receive substantially less government assistance than is true of U.S. or European commodities, and producers are tuning in to new product and market opportunities. Domestic manufacturing is undergoing dramatic restructuring as foreign manufacturers gain increasing access. And a new government elected in October 1990 has promised to release the final shackles of a restrictive labor and wage system.

The transition is by no means painless. Unemployment has reached double digits and regional discrepancies in economic potential are glaringly evident. Perceptions of differential access to the freer marketplace have brought cultural tensions to the

surface and highlighted the need for a more highly educated citizenry. Whole industries have collapsed while new ventures are barely under way. The nation is still struggling to establish new niches in the international market.

Thanks to the Fulbright program, I have been able to watch firsthand the development of "perestroika down under." New Zealand will succeed in the long run because its people understand work, appreciate education and technology, and are making progress in reorganizing their economic infrastructure. But as they turn the corner, I suspect many will glance over their shoulders and wonder why it took so long to change course.

There must be an axiom in some branch of science to the effect that the longer a certain course is followed, the more difficult it is to shift to another course—a dynamic extension of the inertia principle.

New Zealand is fortunate. Its side trip lasted only two or three decades and never led completely out of sight of the economic mainstream. The excursions of Eastern Europe, the Soviet Union, and much of the developing world have lasted far longer and ranged much farther afield. Judging by New Zealand's experience, theirs will be tumultuous and the rides will be long toward full participation in the world economy. ■

*John Braden is professor of agricultural economics at the University of Illinois at Urbana-Champaign. Prior to his stay in New Zealand, he worked briefly in the Gambia. Braden is currently planning a collaborative international project to compare environmental policies in Europe and the United States.*

## The Peace Corps in the 1990s

Barbara Zartman

There is probably nothing that so completely represents most people's concept of the Peace Corps than the image of an earnest young man or woman from America's heartland working in the African bush teaching farmers a better way to plant crops. It is an image that is old as black-and-white television and "Ozzie and Harriet." In the decade of the 1990s, agriculture is still a mainstay of Peace Corps programming, but it is more sophisticated; it involves many other organizations; and it is far more respectful of the talents of our host-country counterparts.

Overall, the Peace Corps of the United States has nearly 6,500 volunteers and trainees currently serving in 73 nations of the world. This number is mandated to reach 10,000 volunteers by mid-decade, when we are likely to be working in nearly a hundred countries. The current volatile international climate has seen rapid escalation in requests for Peace Corps volunteers, and the agency will bring programs to more new countries in this eighteen-month period than we have in the last eighteen years!

The volunteers themselves are changing: half are women, a tenth are over 50 years of age (the average age is now just over 30), and as a result of aggressive efforts, they now more closely represent our nation's racial and ethnic diversity.

As the developing world has advanced, so too has the degree of sophistication in requests for assistance and the range of volunteer assignments. In addition to the traditional sectors of agriculture, education, and health, we have added new sectors in the environment, small business development, and urban programs. In response to requests that





Peace Corps volunteers in Tunisia assist farmers in applying new management techniques to the local beekeeping industry. The project aims to combine the best of the new and the traditional into techniques that will provide long-term benefits for Tunisian agriculture.

we send volunteers with advanced degrees, we have entered into collaborations with graduate schools to combine a year of on-campus study at the master's degree level with a two-year Peace Corps assignment in a promising range of Master's Internationalist programs at American universities.

### New challenges

The challenges faced by volunteers—and by the world community—are enormous: over the next dozen years, world population will expand from five billion to six billion people. In order to maintain just current consumption levels, a 26 percent increase in the world's overall grain production yields would be required. Those levels are sadly inadequate, however, with an estimated 35,000 people dying daily worldwide from the ravages of hunger. Environmental pressures, desertification, rural migration, and geopolitical instability only compound the difficulties.

Within this context of change, there is the constant of the Peace Corps mission: volunteers working in hands-on cooperation with the host-country nationals to better feed their people. They learn the local language and customs, live for two years as their counterparts do, and return saying—almost to a person—“I have gotten so

much more than I gave.” Nearly 130,000 Americans have answered the call, and over 95 percent say they would do it again.

Currently one volunteer in five has his or her primary assignment in agriculture; nearly as many have agriculture projects as their secondary

assignment. These projects might be in crop production, apiculture, aquaculture, livestock husbandry, marketing, farm business management, soil science and conservation, on-farm seed production, agricultural extension, cooperatives, rural youth development, farm mechanics, or agricultural research.

### Indigenous talents

The 25,000 Americans who have served as Peace Corps agriculture volunteers have learned a deep respect for the value of host-country counterparts' knowledge, a respect that continues to influence project strategy. Farmers throughout the developing world possess skills evolved over hundreds of years of intimate knowledge of their land.

As an example, traditional farmers can be found throughout Africa who employ complex cropping systems that illustrate a careful balancing of the agroecosystem. Peace Corps volunteers are learning much about the wisdom of these systems, knowledge that can be shared among communities beyond those nations' borders.

Peace Corps' Africanized-bee management project in Latin America is another example of the transfer of indigenous knowledge: the “killer bee” so sensationalized in the popular press has been worked with for

hundreds of years by African beekeepers, and our volunteers are playing a leading role in successfully adapting and transferring know-how for the management of these valuable insects in our own hemisphere.

Concomitant with this increased attention to the transfer of indigenous knowledge is respect for the prerogative of a community to take a central role in charting the course of its own development. Experience has shown that a development project must respond to the needs and priorities of the targeted community, not those of an outside institution, if it is to be truly successful and sustainable.

### Collaboration

The Peace Corps could accomplish little of its work overseas without the superb cooperation and support it receives from nonprofit and nongovernmental organizations, as well as from other governmental agencies. Whether it is Catholic Relief Services in Mauritania or CARE in Ecuador or Winrock International in Nepal, we are indebted to dozens of other programs that help to meet human needs around the world.

American corporations also lend a hand, such as the seed company that has provided our volunteers and their counterparts with more than twenty tons of vegetable seed; that's more than a million dollars' worth to help people from Belize to Zaire. American children, like those at the H.R. McCall Elementary School in Waukegan, Illinois, combine their pennies to adopt a rural school in Durali, Nepal: they sent \$400 to finance repairs through the Peace Corps Partnership Program.

### Farmer-to-farmer exchange

On a far different scale, the United States Agency for International Development provides funding for a range of agriculture projects, but one in particular deserves attention: the Farmer-to-Farmer (FTF) exchange, operated in collaboration with the Volunteers Overseas in Cooperative Assistance (VOCA). Since the program began in September 1987, VOCA

has provided technical assistance to Peace Corps volunteers and their host-country counterparts in more than 40 countries.

The Farmer-to-Farmer program provides experienced U.S. agricultural professionals to assist in Peace Corps projects overseas, where the goal is to improve the productivity and income of host-country farmers. These volunteer consultants serve from four to sixteen weeks in a broad range of agricultural disciplines.

VOCA administers the program and recruits the appropriate volunteer consultant in response to requests initiated by our Peace Corps volunteers overseas. The United States Agency for International Development funds the Farmer-to-Farmer program and covers the VOCA volunteers' travel and living expenses.

The advanced skills and knowledge of these very special Farmer-to-Farmer volunteers have proven invaluable in support of Peace Corps volunteers and staff. An FTF horticulturalist/landscape architect helped re-establish two botanical gardens in Western Samoa, while devising a mist system to improve root propagation in dry season, designing a record-keeping system and locator chart, initiating a plant-collecting tour, advising on preservation techniques for library books in a humid climate, and conducting workshops on basic horticulture for both Peace Corps volunteers and key staff from the National Parks and Forestry Service.

### Work at home

Because the experience of volunteers overseas is so rich with lessons, we are embarking on a post-service program called the Peace Corps Fellows/USA. It is an effort to link returned volunteers with tough, full-time assignments that require their special talents, language skills, and cross-cultural awareness—jobs that can be linked with an opportunity to continue education in their chosen field. We welcome inquiries from the American agricultural community about establishing such Fellows

linkages program that can tap the talents of former volunteers.

We think the Peace Corps experience is just too good to leave overseas.

*Barbara Zartman serves as deputy director of the United States Peace Corps. In that position, she assists Peace Corps Director Paul D. Coverdell in overseeing more than 7,000 volunteers and staff serving in more than 70 countries around the world. She is responsible for domestic programs, including minority outreach, academic collaborations, and Congressional relations.*

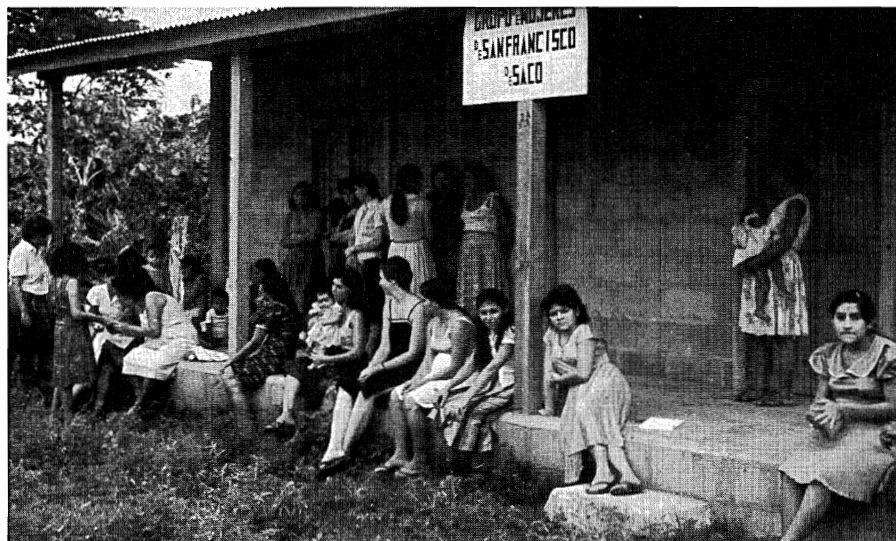
## Reflections on a Peace Corps Experience

Karen Russon

**I**t has been seven years since I returned from the Peace Corps. My assignment was to work with a women's embroidery cooperative in a small village on the north coast of Honduras. The passage of time and space has allowed me to step back and take an objective look at my experience.

While I was with the women's cooperative, I wrote a grant proposal and received substantial funding. With the money, the cooperative bought a parcel of land and built a meeting house. The women bought material in quantity and funds were available to pay a salary to the coop's manager.

When I left after two years, however, there were many problems that seemed unchanged. The women were still hesitant to boil their water, which came from a polluted river nearby; they continued to resist taking on responsibility in the coop; and their diet was improved, but not to an appreciable degree.



Karen Russon joins members of the women's embroidery cooperative on the porch of the meeting house of the Cooperativa San Francisco de Saco in Honduras. Part of the international funds supporting her work went toward building this new meeting house.

## The struggle for change

Although my principal role as a volunteer was to help the coop's manager in developing administrative skills, I found myself devoting almost as much time to giving health talks on topics such as boiling water, keeping animals out of the house and flies off the food, and the dangers of infant diarrhea. I repeated these warnings over and over again. Conditions did not appear to change much.

Although I was discouraged by the number of women who did not feel a need to boil water for their own consumption, I did note that they began boiling water for their children. An immediate result may not appear from this change, but the quality of life of their children may be improved as they grow to be healthier adults.

I think the same can be said for discussions with the women regarding common infant diarrhea. It was common practice to refrain from giving a baby any liquids to stop the diarrhea. The child would grow weak and sometimes die. By administering boiled water with sugar and salt added, this problem could be avoided. As women alter their practices in dealing with this problem, infant mortality should gradually decline in the village.

I felt frustration as the women were continually reluctant to accept responsibility within the cooperative. They were dependent on the manager for bringing embroidery materials to the village and paying them for the work completed. No one wanted to accompany the manager and me to the larger city to buy raw material or to look for prospective sales outlets.

When attempting to elect officers for the cooperative, all sat with eyes downcast. No one would volunteer herself or even nominate another member. The manager had to select individuals as candidates and then the rest of the membership would vote on them. Everyone was concerned that they would be considered arrogant and self-centered if they took the initiative or leadership within the group. It was immensely difficult to dispel this notion. The lack of self-confidence was an

underlying cause of much of their behavior.

However, it is possible that these women derived secondary benefits from the cooperative experience. Provided with an opportunity to organize with other women, they could air common problems and gain new perspectives. A feeling of solidarity could be developed. The women were forced into having to make decisions for the group, dealing with democratic principles, and taking some leadership. Over time, making simple decisions and seeing the positive results from those decisions may lead to the development of improved self-confidence and self-esteem in the women.

## Assessing the long-term benefits

My initial impression upon leaving Honduras seven years ago was that I had gained much from my two years in the Peace Corps, but I questioned how much the women in my cooperative had benefited. Time and distance have changed this impression.

I have decided that Peace Corps volunteers often expect immediate and direct results from their work while development, in reality, is a long-term proposition. The full benefits may not be felt by the women with whom I worked for years to come.

No volunteer's service is without multiple frustrations and setbacks. One must realize, however, that the seemingly small, incremental changes that occur over the two years of a volunteer's commitment may lead to greater, longer lasting changes in the way that individuals and a community at large will think and act. ■

*Karen Russon is an International Agricultural Development Specialist with the Office of International Agriculture at the University of Illinois at Urbana-Champaign. She is currently in charge of commodity procurement for the College of Agriculture's TIPAN project in Pakistan. In addition to her Peace Corps experience in Honduras, Russon has spent two summers in Bolivia and has traveled extensively in Central and South America and in Europe.*

## Putting the Peace Corps Experience to Work

Pamela Woodard

"A union card for international development work," is one of the best descriptions of Peace Corps volunteer service that I have ever heard. Now at the end of my third year working in the field of human resource training for development, I have discovered that this "union card" has indeed been very helpful.

Development professionals, many of them former Peace Corps volunteers, usually recognize Peace Corps service, rightly or wrongly, as "legitimate" overseas experience or work. International students also seem to value this experience. They appear to feel more comfortable working with me knowing that I have a non-U.S. base for cultural reference and a desire to understand other peoples and cultures.

From my personal experience, the sixteen months that I spent in Tunisia during 1986-1987 as a rural development extension volunteer probably were more beneficial to me than to the extension office or to the farmers with whom I worked. For me, Peace Corps provided the crossroads where my internationalism could meet my professional interest in rural development and extension. I feel that Peace Corps service did give me a valuable entree to the professional world of development where, in the course of my lifetime, I hope to accomplish worthwhile goals.

Those people who know me well know that I have a number of criticisms of the Peace Corps. During my term of service, Peace Corps-Tunisia's in-country administration was suffering from strained relationships with volunteers and host-country counterparts and from a lack of leadership, as a result of changing directors three times. This led to the

early termination of many volunteers and the lack of an initial assignment for others, including myself. However, despite many disappointments, what was ultimately important was "The Experience." From that experience, I learned many lessons which are invaluable in my work with international agricultural trainees.

## Lessons from the Peace Corps experience

What lessons did I learn and what lessons could be learned by others who choose volunteer service? Here are a few. "Which is better? Tunisia or America?" Hardly a week went by without hearing that question after I returned to the United States. While I lived in the village of Makthar, I learned that life is not inherently better or worse in any country—just different. Value judgments about people and their culture usually serves no useful purpose in development.

I also learned that when you've given your best in any situation, don't beat your head against the wall; just look for the next door of opportunity. Development is a process that will go on in Tunisia and elsewhere through the concerted efforts of local people, not that of a single Peace Corps volunteer. Failure can be and is a part of that process.

A third lesson which I learned was that long-term contact with other people and cultures is essential to

developing non-paternalistic attitudes and approaches to development. Without understanding the total picture—economically, technically, politically, and socially—we will keep making the same mistakes as those before us who have worked in development.

Lastly, I was taught the hard lesson of loneliness and separation from my own family and culture, something that I see international students struggling with every day. This lesson has helped me to be a better counselor to students who are experiencing culture shock and homesickness.

Does Peace Corps service automatically ensure that you will gain cultural understanding or a realistic view of the problems of development? I don't believe so. Some of the volunteers with whom I served never allowed themselves to become close to Tunisians or Tunisian culture. They spent their days with other Americans, with books, with travelling, or they simply went back to the United States early. Being in a different country is not enough.

Being sensitive to people is what really fosters understanding and prepares one for international development work. Bargaining at the local market for oranges, steaming for hours in the "hammam" (Turkish bath), drinking tea with a group of women and talking about how they raise rabbits—all of these activities put me in contact with people, who themselves

are the carriers of culture. Being physically close and mentally in tune with people who have a different cultural orientation has helped to develop my ability to see situations, problems, and solutions through different eyes.

For me, language was the key that provided entry into the culture. Once a wrinkled, old man gave me a bucket of freshly picked mulberries simply because he was so happy to hear a foreigner speaking his language. Command of another language is probably the most important skill that I developed during my sixteen months in Tunisia. More needs to be done to capitalize on the language ability developed by volunteers upon their return to the United States.

## One experience among many

"Would Peace Corps service be right for me?" is a question I have frequently been asked since my return. I always preface my answer with the caution that my Peace Corps experience is only one among many.

My advice is to investigate positions with several volunteer organizations and talk to several volunteers who have recently served in the country where you want to go. If possible, speak with volunteers who returned early or had less than stellar experiences. This will give a more balanced view of the potential situation. An informed decision is the best decision.

All in all, I highly recommend "The Experience," especially for those who have chosen development work as a vocation. ■

*Pamela Woodard is an International Agricultural Development Specialist with the Office of International Agriculture at the University of Illinois at Urbana-Champaign. Woodard currently assists in ongoing training for degree and non-degree students from Pakistan, Kenya, and several other countries. Besides her experience with the Peace Corps in Tunisia, she has participated in the international exchange program sponsored by 4-H.*



Pamela Woodard learns firsthand about daily life in Tunisia by helping a friend dry homemade couscous, which is a local wheat-based staple similar to pasta. Such cultural interactions are key elements in the true Peace Corps experience.

# INTERNATIONAL AGRICULTURE

UNIVERSITY OF ILLINOIS  
AT URBANA-CHAMPAIGN

COLLEGE OF AGRICULTURE

Update

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## Assisting Democracy in Poland and Eastern Europe

The topic for this issue of *International Agriculture Update* is especially meaningful for the University of Illinois, which is planning several new development efforts in Poland. As the iron curtain is lifted from Eastern Europe and the Soviet Union, we are committed to building upon the special relationship between the state of Illinois and the Polish people.

Today Chicago stands second to Warsaw as the city with the largest Polish population in the world. More than one million Polish Americans, comprising one of Illinois' largest ethnic groups, live in and around the city of Chicago.

Not surprisingly, Illinois was the first state to open a trade office in Poland. In July 1990, Don Grabowski, University of Illinois trustee; Jack Rundquist, then director of the Illinois Department of Agriculture; and I were privileged to be on the trade delegation of then Governor Jim Thompson, who played a key role in opening the office.

As a result of that and several subsequent trips, numerous doors were opened to us and to Illinois agribusiness. In fact, a consortium of 35 Illinois agribusinesses, led by Doane International, are bidding with the Polish National Alliance, the Illinois Department of Agriculture, and the College of Agriculture at the University of Illinois on a USAID-funded project for restructuring agriculture and agribusiness in Poland. The University's effort is spearheaded by the Department of Agricultural Economics through Department Head

David Chicoine, Assistant Professor Jerry Nelson, Associate Professor Laurian Unnevehr, and Lowell Hill, the Laurence J. Norton Professor of Agricultural Marketing.

The University has established memoranda of agreements with several academic institutions, including agricultural universities in Warsaw and Poznan, and with a number of provincial governments in Poland. The College of Commerce and Business Administration has just received a Mellon grant to establish a business school at the University of Warsaw. Many other examples could also be given.

Following this theme of development in Poland and Eastern Europe, we are pleased to present guest articles by Senator Jozef Slisz, vice marshal

and deputy leader of the Polish Senate; Dr. Carol Adelman, assistant administrator of USAID's Bureau for Europe; Gene Koch, president and chief executive officer of Doane International; and Edward Moskal, president of the Polish National Alliance and the Polish American Congress.

We trust their insights and comments will illuminate the path of our cooperative ventures as the veil of darkness is completely lifted in Poland. Together we all stand to gain as Poland and its wonderful people create a true market economy. □

John J. Nicholaides III  
Director, Associate Dean,  
and Assistant Vice Chancellor  
for Research

## Transforming Polish Agriculture to a Market Economy

Jozef Slisz

During World War II, more than 70 percent of Poland's agricultural infrastructure was destroyed. As a result of postwar border changes, Poland gained western territories that were devastated and thinly populated. Moreover, Poland absorbed more than five million people from the eastern territories that had been taken over by the Soviet Union. Most of these

people settled in the rural areas of Poland.

In the early 1950s, a process of collectivization in agriculture began based on seizing private land. Organized resistance by private farmers against this policy led in 1956 to limitations on collectivization.

Although most private farmers protected themselves against collectivization, agricultural sectors such as small agribusinesses, processing, services, and trade were transformed to state-ownership or to quasi-cooperatives. The agricultural policy during the entire communist period was based on allowing private agriculture to exist but forbidding it to develop. Earnings by the private agriculture sector were always transferred to heavy industry.

### The changing economy

The first important breakthroughs in agricultural policy came with the change in the political system and the decision to transform to a market economy in 1989. Recent Polish history, however, has created a specific land structure that still remains today.

Of the 18.9 million hectares of arable land, 76.3 percent is in the hands of private farmers; the remaining 23.7 percent belongs to the state sector. Private farms, unable to develop for 45 years, have changed little in size. Currently, there are 2.28 million private farms, totalling 13.6 million hectares, with an average size of 6 hectares per farm.

In the southeast and central regions, the average size of a farm is four to five hectares. In the west and northern parts of Poland, the size of most farms is ten hectares or more.

Efficiency in production has been hindered by the disadvantages of this agrarian structure. The lack of development possibilities in recent years has caused a shortage of technical equipment on the farms.

About 27 percent of the Polish population is employed in agricultural production. About 40 percent of the population lives in rural areas. These numbers are several times higher than



This street vegetable vendor is just one example of the limited free-market structure that managed to survive in Poland under Communist rule. Such experience with capitalism places Poland in a position to move more quickly than much of Eastern Europe toward a full free-market economy.

in West European countries or the United States.

In the past, farmers have always opposed the communist regime, accepting as a group to be "second class" citizens and sentencing themselves to a low-income existence. Within all the countries of the communist bloc, Polish farmers, however, were the only ones who privately owned the majority of the land, which served as something of a substitute for a market economy.

### The new challenges

At present, Polish agriculture faces many challenges. The most important are:

- Improving the agrarian structure;
- Equipping farms with modern technology;
- Reducing farm employment;
- Developing an industrial environment in sectors such as modern fruit, vegetable, and meat processing plants, services and trade, and distribution systems; and
- Developing basic infrastructure such as telecommunications, gas and water supplies, improvement of existing electricity lines, transportation, banking, and credit.

The fundamental requirements for these changes are the right of private ownership and the resulting implementation and development of a free market economy. Among the activities that could accelerate these changes are returning state-owned land to the private sector, returning confiscated plants to their former owners, and restoring state-owned or cooperative plants to the private sector. The poor financial condition of both state and rural areas, however, inhibits quick transformation in agriculture.

Thanks to private farmers, Poland is a country with an agricultural production capable of feeding the whole nation. Moreover, it has surpluses that can be exported. There are, however, major problems in exporting agricultural products because of the competition in prices from West European goods and the recent loss of the Soviet market. The problem is not that prices are too low in the West but that the prices of Polish agricultural products are too high. These high prices are caused mainly by an inefficient, state-owned processing industry.

Poland must reduce employment in the agricultural sector. This should be achieved through development of services and agricultural processing

industries. Polish products have many potential quality traits that are desired by consumers: farmers use less chemical fertilizer and pesticides and concentrate on organic fertilizing. The resulting products are ecologically preferred. This advantage, however, is eroded by the lack of adequate processing facilities, market organization, or proper packaging materials.

Poland is paying attention to the development of agribusiness based on foreign technology and funds. The possibilities of involvement of foreign capital are practically unlimited. Cooperation in and transfer of technology and science, as well as farmers' exchanges, will be very important.

Among postcommunist countries, Polish agriculture, with the majority of land already in the hands of private farmers, has the best chance for reorienting to a modern market economy. The development of Polish agriculture is closely watched by other countries, and in particular by the Soviet Union.

Polish experience and success in transforming from state-owned systems to private farming and organization of agribusiness is extremely important for Poland itself and for other East European countries. The political solutions in agriculture are closely related to the political system of a country. There cannot be a political system based on democratic markets and pluralism without private ownership of land, plants, and trade.

□

*Jozef Slisz serves as vice marshal and deputy leader of the Polish Senate. He owns and operates a 15.5 hectare farm. In 1980, he led the group of farmers who forced the communist regime to sign the first agreement with private farmers. He is a founder of Rural Solidarity. Senator Slisz headed Rural Solidarity until December 15, 1989, when he helped organize the Polish Peasants' Party - Solidarity (PSL - Solidarnosc).*

## The USAID Agenda in Eastern Europe

Dr. Carol C. Adelman

The Agency for International Development (A.I.D.) has designed a program of assistance for Central and Eastern Europe that is vital to the economic and political restructuring of the region. Agriculture and agribusiness are critical components in that development program.

Agriculture and its related industries play an important role in the regional economy. Agricultural exports are significant for many countries in the region, contributing to employment and economic growth. Additionally, an adequate supply of food is important for creating the climate of stability needed for political reforms.

### A food systems approach

The Bureau for Europe has created a "food systems" approach to agricultural development, which introduces a



Volunteers in Overseas Cooperative Assistance (VOCA) are helping Poland's Kleczanow cooperative to develop new marketing alternatives. This initial effort to provide technical and managerial assistance to cooperative managers in Poland is part of an overall assistance plan developed in cooperation with the U.S. Agency for International Development.

market-oriented strategy for agriculture and agribusiness. Agricultural production is viewed as only one component of the larger food chain, from farm services through production, processing, marketing, and finally to the consumer. With this approach, we are nurturing partnerships with American businesses, universities, and nonprofit organizations to provide the agricultural expertise required to promote market forces.

For the past year, A.I.D. in Europe and the Near East has vigorously pursued a strategy of development through "Open Markets and Open Societies." "Open Markets" lead to the proliferation of trade, investment, and jobs and allow people to choose what they produce and consume, where to work, what to invest in, and how much of their profits to retain. "Open Societies" embody the rule of law and freedom of press, speech, and religion. These rights lead to the proliferation of political and economic interest groups (cooperatives, business and trade associations, trade unions) that are essential for maintaining open markets and constitute an important counterweight to central government control.

These dual concepts are central to A.I.D.'s overall development assistance strategy for Central and Eastern Europe, and are the foundation for the three objectives of the program: strengthening democratic pluralism; privatization and economic restructuring; and improving the quality of life. This strategy offers the best prospects for self-sustaining economic development and the reduction of poverty.

The historic changes in Eastern Europe provide a unique opportunity to advance democracy and economic freedom. Nevertheless, the new governments in the region face a daunting series of technical, financial, and political challenges. Although our overall program in Central and Eastern Europe is not a typical A.I.D. program, it serves as an example of what the Bureau is working to accomplish in agriculture.

Within the objective of economic restructuring exist the Agribusiness Development and Trade and Market Development programs. As part of the Restructuring Agriculture and Agribusiness Project, these two areas have been selected as particularly important for the agricultural sector and are the centerpiece of the Agency's agricultural activities in the region.

Our initial analyses of Central and Eastern European agriculture found that development is severely constrained in the short run by ineffective input delivery and output distribution systems and the absence of an effective, open-market pricing system to guide resource allocation. While individual countries have unique problems, it is clear that price signals are distorted in the overall system. For example, private production and land ownership in Poland is legal and input pricing has been liberalized. Nevertheless, many commodity prices remain fixed at less than market levels, creating powerful disincentives for producers.

State-controlled cooperatives have developed little understanding of marketing, pricing, or even accepted standards of quality. Members therefore cannot get desperately needed services or adequate information. Business managers have little or no experience functioning in "bottomline" enterprises, and the type of training they need is unavailable or inadequate for them to make this leap. A vigorous and dynamic agribusiness sector which can operate effectively in an open market system will eliminate these constraints as a necessary first step toward growth and development of agriculture throughout the region.

### Technical assistance and training

We have developed a program that extends technical assistance and training to Central and Eastern European agribusiness enterprises and helps them understand how to operate in an open market system and assists with privatization of state-owned enterprises. We are also furnishing

similar assistance to public sector agencies to facilitate a free market system. These agencies can help provide access to accurate market information, agricultural statistics, grades and standards, health and sanitation requirements, and agricultural policy.

Two major difficulties exist in pursuing this strategy. First, it is not easy to restructure centrally planned economies into market economies. Second, while all of the Central and East European economies have been centrally planned for many years, they are not all the same. Significant differences exist among the economies of the countries in the region. Because the countries have not completed the overall transition from centrally planned economies, we are developing various approaches with a variety of participants, including cooperatives, private and voluntary organizations (PVOs), universities, for-profit service firms, and for-profit U.S. agribusiness enterprises.

### Restructuring agriculture

All the agriculture and agribusiness activities are funded under one A.I.D. project, the Restructuring Agriculture and Agribusiness Project, with a planned funding level of \$67 million for three years. The project is regional in scope, including several country-specific programs. About two-thirds of the resources will be directed to the private sector and one-third to the public sector, channeled exclusively to those public agencies necessary for an open market system.

American institutions of higher education, PVOs, foundations, cooperatives, for-profit agribusiness enterprises, for-profit service enterprises, and other interested organizations are encouraged to form consortia to propose technical assistance and training for Central and Eastern European agribusiness enterprises. The concept for a cooperative agreement with A.I.D. is simple. Because there is no "model," it is impossible to determine exactly what type of assistance will be needed to convert



the public sector into private enterprise. Therefore, we will bring together a wide range of skills and talents under one managing entity to provide various kinds of assistance.

Including American operated agribusiness enterprises in these consortia has two purposes. One, such enterprises bring a practical perspective that has been missing in many A.I.D. projects. Two, exposure of U.S. enterprises to Central and East European enterprises will foster increased opportunities for trade and investment.

### Initial activities

Although the Restructuring Agriculture and Agribusiness Project is just getting started, we are already conducting several initial activities. For example, A.I.D., with the help of the Volunteers in Overseas Cooperative Assistance (VOCA), provided technical assistance for managers and executives of Polish cooperatives in 1990. VOCA volunteers have also helped a Polish state cooperative make the transition to a privately owned cooperative which was able to double the price of its primary product by entering export markets.

This cooperative has now taken a loan from another U.S. program, the Polish-American Enterprise Fund, and is expanding its operations. While it is still too early to measure our success in promoting joint ventures and other investments in Central and Eastern Europe, our initial experiences have been positive.

Agribusiness development is essential for the overall development of the agricultural sector. The participation of U.S. agribusiness will be a critical element in putting together a successful agricultural assistance program in Central and Eastern Europe. The Bureau for Europe will continue to emphasize the key role of agribusiness in development and explore ways of implementing effective private sector partnerships in all of our development assistance programs. □

*Dr. Carol C. Adelman currently serves as Assistant Administrator for Europe in the U.S. Agency for International Development and manages U.S. foreign aid programs for Central and Eastern Europe. In 1989, Adelman supervised assistance to support the first post-war elections in Poland, Czechoslovakia, Hungary, Bulgaria, Romania, and Yugoslavia.*



Much of the farm equipment in Poland is outdated and too small for efficient production. Increased and upgraded mechanization is just one of many changes needed to solve Poland's complex problem of establishing a modern and reliable food production and processing system.

## The Role of Illinois Agribusinesses in Eastern and Central Europe

H. Gene Koch

How to provide the best possible assistance for agriculture and agribusiness development to the newly emerging democracies of Eastern and Central Europe is a very complex question. Some of the conditions that affect agriculture and its potential for advancement in these countries are land ownership, the need for an accessible infrastructure, and

access to financial assistance. These are major hindrances faced by companies trying to provide any form of assistance. In addition, these countries lack a current base of scientific knowledge and a management structure that understands the fundamentals of modern agriculture and the position of agribusinesses in support of agricultural advancement.

The agroindustrial sector of Eastern and Central European economies still operates far below its potential, and, more importantly, it operates far below society's needs. Labor productivity, crop yields, and animal productivity are much lower than those in the developed nations. Growth rates of food production are insufficient. Processing and storage facilities for agricultural products are also inadequate. As a result, these countries buy large amounts of food from the United States and Western Europe. They pay dearly for this deficit, both economically and politically.

### Assisting the agribusiness sector

Almost five years have passed since perestroika began in the Soviet Union and Eastern Europe, and change is well under way. The processes of this change are not well understood by the western world. Therefore, it is difficult at times for Americans to accept that perestroika is gaining strength in the political, economic, and legal spheres. Most important are the changes in the consciousness of the people and in the democratization of public relations.

Yet, economic problems have become and will continue to be the center of attention today and well into the future. Special attention is being paid to the agroindustrial complex of these countries. The importance of this sector in the individual economies is increasing.

One of the major problems associated with the agricultural sector is that of private ownership. The state owns most of the agricultural enterprises and organizations in these countries. Private ownership at any level in the

system is very limited. Although they want to help, Illinois agribusiness companies have problems conducting business.

Other problems in developing agriculture are the lack of technology and the management skills associated with a free market economy. The movement away from a command economy to a free market economy in itself creates a whole new layer of problems in addition to those associated with ownership and the lack of an incentive structure.

Major steps must be taken to change the system radically. Market-driven pricing policies must be pursued, management incentives must be reorganized to provide priority to the producers' interests, and a production-oriented infrastructure must be created to support private ownership and competitiveness. These changes will stimulate the private producer to work efficiently and accelerate the integration of new technology and market-driven advances into the agroindustrial economies of these countries.

Finally, it is vital that the agricultural policies of these countries intensify productivity through an acceleration of scientific and technological advancement. In these fields, the agribusinesses of Illinois have much to offer these countries.

### Using the American model

The interest of these countries in American farming and food processing is greatly increasing. Using the "American Experience" in agriculture as a model for problem solving must be approached by both sides as a long-term process. This process will need to introduce a large-scale training program for farmers in production and for agribusiness people in processing, storage, and marketing of commodities and processed food stuffs. Illinois agribusinesses must understand that the problems associated with the agricultural economies of these countries did not happen yesterday, nor even five to ten years ago. They are a result of forty to fifty years of

erosion of private and rural productivity in a free market society.

I believe that two primary ingredients are critical for success: land reform from within and scientific cooperation and advancement support from other countries. Solving the complex problem of establishing an efficient food production system cannot be done without scientific development and the restructuring of the research and development system.

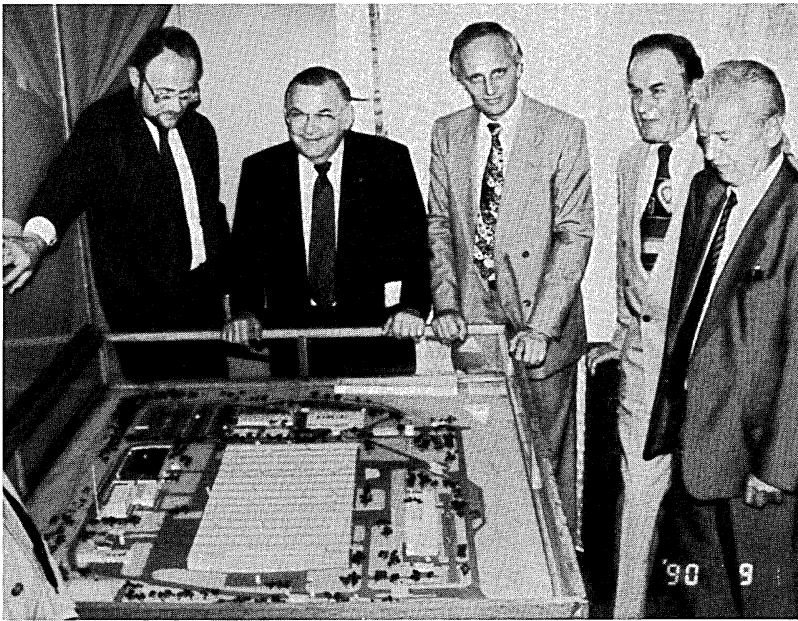
Some of the key elements of the solution are:

- The people involved must think of themselves as masters of the land and as highly skilled workers who are proud of their work and are rewarded for it.
- A free market system must be created to reward efficiency and quality.
- Training and education must be used to develop skilled managers for private production.
- Improved technologies and agronomic practices must be put into place at all levels of production.
- Improvement and development of crop varieties and hybrids should be implemented in regions where it can be accomplished effectively.
- Improved mechanization should support the increased efficiency needed in all types of production and processing.
- New food products must be developed to fully use the produce of these countries.
- A model of the entire food production, processing, and distribution system of each country is needed to help identify inefficiencies and areas of improvement. □

*H. Gene Koch is president and chief executive officer of Doane International, Inc., a major international agribusiness firm. He has 27 years of experience in corporate management. Since 1975, he has managed companies involved in commercial aviation and agricultural services, with a primary emphasis on international markets.*

## Opening Doors to Poland

Edward J. Moskal



Ed Moskal (second from left) and Les Kuczynski (far left) of the Chicago-based Polish National Alliance show Polish officials a model of the new meat processing plant that will be built near the town of Kielce. The plant is a joint Polish and United States business venture and, when completed, will be the largest meat processing plant in Europe.

As president of the Polish National Alliance and the Polish American Congress, I have made several trips to Poland since the historic change in political leadership in 1989. The visits were fact-finding trips, seeking a bridge for Polish-Americans to determine how they can assist in opening doors to a market economy and a democratic form of government. We met with officials in the ministries, farmers, students, workers, and homemakers.

At times it seemed the question was "Where do we begin?" So much need went begging. But, after a while, it became apparent that for Poland the road from a socialist state to a market-oriented democratic state was through agriculture.

Poland, after all, ranks fourth in the world in potato production. It produces about 5 percent of the apples in the world and more than 10 percent of the strawberries and raspberries. Historically, Poland was a leader in cereals such as wheat and rye. Referred to as "Europe's breadbasket" before Communism, Poland could once again be the leader.

In Poland, agriculture long served as an economic base, with many small farms in private hands. The hard-working farmer was always a proud citizen, not taken over by communism. However, the basic infrastructure was missing—the storage facilities, the transportation network, the distribution system, and the consumer's ability to purchase at stable and predictable prices. This is where the Polish farmer needed the help of Western technology, know-how, and experience.

### Leadership from Illinois

Being from Chicago, Illinois (the soul of Polonia), we did not have to go far for assistance. Our state is home to a strong agricultural presence in the world marketplace. The list is long—John Deere, DeKalb Seed and its subsidiaries in poultry and swine production, Archer Daniels Midland, Quaker Oats, to mention only a few, and of course the leader in agricultural

research—the University of Illinois College of Agriculture.

With the assistance of former governor James Thompson and the Illinois legislature, which funded the opening of the State of Illinois Trade Office, the vehicle was put into place to introduce Illinois farm experts to Poland.

Our organizations have lobbied strongly in Washington, D.C. for programs in agriculture. One excellent program was through the Volunteers in Overseas Cooperative Assistance (VOCA), which has received \$1 million for its Poland project. Several Illinois farmers are part of the VOCA program working to restructure co-operatives along private lines. Future areas of involvement include rural water works, banks, and credit for small farmers.

### Investing in Poland

Key areas which still need to be addressed are assistance in the poultry industry and with dairy products. For example, last December when I was in Poland, I was shocked to learn that eggs were sold singly as their cost was quite prohibitive—one dollar each.

Unless someone leads, who will follow? With a "put your money where your mouth is" philosophy, the Polish National Alliance helped bring together and invested in a meat processing plant near Kielce, Poland. This joint venture has a 51 percent U.S. involvement and includes, on the Polish side, ANIMEX—best known as the U.S. distributor of Krakus label hams. The developer of this project is the Chicago-based A. Epstein and Sons. The manager of the meat processing plant has not been selected, but most probably will be ConAgra, a world leader in meat processing. Both companies are top-rated managers and will bring to Poland state-of-the-art technology and equipment for meat processing and production.

Bank loans have been received, and credits for production facilities and suppliers have been obtained. Equipment will be bought from the United States, guaranteeing the latest technol-

ogy on a timely delivery schedule.

Once completed, the plant will be the largest in all of Europe; it will employ 1,200 people, and have contracts with over 2,500 farmers to supply the livestock—35,000 cattle and 250,000 hogs.

### Providing agribusiness training

Poland is a country of almost 40 million people, and the means for the agribusiness training must be quickly put into place. Representatives from the University of Illinois College of Agriculture were in Poland for a three week fact-finding mission in February. They came back with projects that would help Poland's agricultural infrastructure. These included projects such as pricing, establishing a futures exchange so that a farmer would know at what price he could sell his crops, and developing models for export sales and other distribution networks so that farm goods could flow in the market place.

Another Illinois-based company with interest in Poland is DeKalb Swine Breeders, which proposes establishing a modern swine breeding farm to supply breeding stock and advanced technology to commercial swine farms for domestic use, as well as for export to other European countries.

These are only a small sample of initiatives taking place in Poland. Others, which work hand in hand with agriculture, include the formation of a small business center that will assist small business owners in developing their business in a market economy. Another project, which the Polish National Alliance is co-sponsoring with Northwestern's Kellogg School of Management and Arthur Anderson Company, is a three-week seminar for Polish bankers. These programs are bricks and mortar that will form the foundation for many subsequent agricultural projects. Change will not occur overnight in Poland. But the steps to go forward are being made.

With the support of the business community and the headstart offered

by the strong Illinois connection, we will see a renaissance in Poland, as the Polish people join the member nations of a democratically led free-market economy. □

*Edward J. Moskal has served as president of the Polish National Alliance since 1988. During that same year, he was elected president of the Polish American Congress, an umbrella organization uniting more than 1,300 Polish American organizations throughout the United States. The Polish American Congress serves as the primary voice of the Polish-American community on charitable, social, civic, and political matters.*

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# INTERNATIONAL AGRICULTURE

UNIVERSITY OF ILLINOIS  
AT URBANA-CHAMPAIGN

COLLEGE OF AGRICULTURE

Update

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## Sharing the World's Genetic Diversity

HERE IS PERHAPS NO SINGLE ISSUE IN the international agricultural community that draws stronger views than the sharing of the world's germplasm and agricultural technologies. Many countries consider their genetic resources as national treasures and take various steps to prevent their dissemination outside their boundaries. Other countries view their agricultural technologies as proprietary and take action to keep them within their national boundaries.

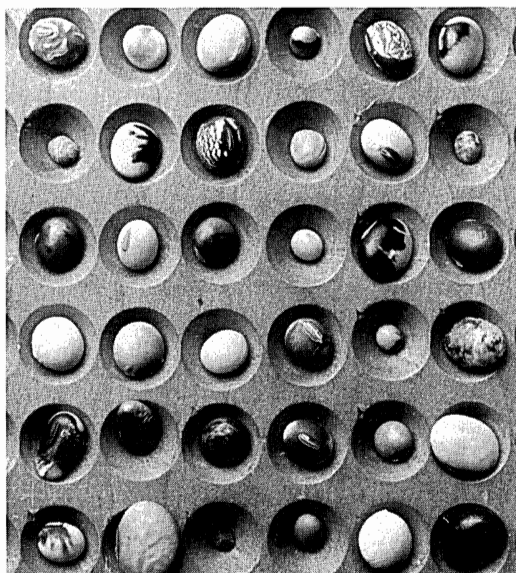
Over time, some countries have come to realize the myopic nature of such approaches. Those who realize that great mutual benefit derives from working together and then take the appropriate action will be the ones who gain the most.

Such could be the case with China and the United States should they begin sharing their soybean germplasm and technologies. In that regard, we are especially pleased to present guest articles in this issue of the *International Agriculture Update* from Sun Huan, vice-president of the Jilin Academy of Agricultural Sciences and vice-chairman of the Chinese Soybean Society; Randall L. Nelson, curator of the USDA Soybean Germplasm Collection and associate professor of agronomy in plant genetics at the University of Illinois at Urbana-Champaign (UIUC); Donald A. Holt, director of the Illinois Agricultural Experiment Station and associate dean in the College of Agriculture at UIUC;

Harold E. Kauffman, director of the International Soybean Program in the College of Agriculture at UIUC, and Lyle E. Grace, Illinois farmer and former official of the Land of Lincoln Soybean Association and honorary life member of the American Soybean Association.

We trust that their respective views on a controversial topic will broaden people's perspectives and perhaps move us closer to sharing the world's germplasm and agricultural technologies with mutual benefit for all concerned. ☛

John J. Nicholaides III  
Director, Associate Dean, and  
Assistant Vice-Chancellor for  
Research



The soybean and its wild relatives exist in a dazzling array of shapes and sizes. Germplasm banks, such as the U.S. Department of Agriculture's soybean collection at the University of Illinois, serve as essential storehouses for preserving the full extent of the world's genetic diversity.

## Benefits of Cooperative Soybean Germplasm Research

Randall L. Nelson

GERMPLASM MAY BE DEFINED AS THE total genetic diversity of a species. Continued increases in food production require improved varieties, and all plant improvement is dependent upon genetic diversity. Germplasm collections maintain portions of this diversity to meet the needs of the scientists that the collection serves.

The U.S. Department of Agriculture's Soybean Germplasm Collection at the University of Illinois contains nearly 14,000 accessions and the Chinese Academy of Agricultural Sciences has more than 22,000 accessions at the Institute of Germplasm in Beijing. As large as they may be, neither of these collections is complete. Even combining these two collections is not likely to contain all of the diversity. Currently there is no way of quantifying the total diversity of existing collections, and certainly there is no way of knowing the limits of the genus. Meaningful exchanges of soybean germplasm enhance all collections involved.

## Turning potential into reality

There are four major aspects in the management of soybean germplasm collections: collection, maintenance, evaluation, and utilization. Collections do not exist until the appropriate material is gathered. This material can include related wild species, traditional varieties, and products of modern research. Gathered strains

must be maintained as viable seeds and periodically reproduced without contamination.

Soybean germplasm collections are not ends in themselves. Genetic diversity in cold storage has potential, but only potential until that diversity is exposed and utilized through plant breeding and genetic research programs. The time, resources, and expense involved in evaluating major germplasm collections are enormous because of the quantity of accessions, the number of characteristics that can be measured, and the large variation that exists for most traits.

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*The proposed exchange of soybean germplasm . . . has the potential to provide direct benefits for both countries and for soybean producers and consumers worldwide.*

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Searches for specific attributes are not always successful regardless of the collection's size. Some genes are known to be extremely rare and some desirable characteristics have yet to be found despite considerable efforts. Once useful variation has been identified, it must be incorporated into high-yielding, adapted varieties before the benefits can be realized.

Assembling and maintaining germplasm collections are large tasks but they require only a fraction of the effort and resources needed for extensive germplasm evaluation and utilization. Unless this work is done, the latent benefits of genetic diversity will never be realized.

## Mutual benefits

The proposed exchange of soybean germplasm between China and the United States has the potential to

provide direct benefits for both countries and for soybean producers and consumers worldwide. The United States is the world's largest producer of soybeans and has in place a large and modern research system combining the expertise and resources of state and federal governments, universities, private companies, and foundations.

Advances in genetics and other plant sciences at the molecular, chromosomal, and whole plant levels in the past decade have provided new and powerful methodologies. These techniques will help solve the problems of soybean production and utilization by identifying and exploiting previously unknown genetic diversity.

The Chinese domesticated the soybean and have the most extensive collection of soybean and wild soybean in the world. They had active soybean breeding programs long before soybean was even considered as a crop in the United States. The soybean is currently grown in a much wider range of environments in China than in the United States.

Soybean is a highly significant part of the Chinese diet. China has more than four times the population of the United States and only half as much arable land from which to feed these people. Both countries would benefit from research programs that increase production efficiency, improve protein quantity and quality, and decrease losses due to diseases and insects. A cooperative effort in germplasm evaluation and utilization would bring together the unique contributions of each country to produce mutually beneficial results that neither could achieve alone.

## A realistic approach

Although a cooperative soybean germplasm project between China and the United States has great potential, we need to temper our expectations with reality. We are fond of extolling the virtues of diverse germplasm, and the value of genetic resources is still a

message that needs to be often repeated. But, if we are not careful, we can become victims of our own persuasion by raising expectations beyond what can be delivered.

Plant improvement is a relatively slow process and using exotic germplasm can significantly increase the time involved. There are no guarantees that any one project will be successful regardless of the effort expended or the resources available. The research can be expensive. With an optimistic scenario, results from this project could have a scientific impact in three to five years but it will take at least twice that long before soybean farmers and consumers would see any benefits.

Some results may be attained relatively quickly but the real value of this project may not even be realized during the lifetimes of the initial participants. Exploitation of genetic resources is a long-term and expensive operation.

If we are to ensure that the soybean will continue to economically produce high-quality oil and protein in environments of increasing biological and non-biological stresses, we have no choice but to expand germplasm research. Scientists from China and the United States can greatly increase the chance of success in this endeavor by each contributing their own resources and working together on shared goals. ☞

*Randall Nelson is a supervisory research geneticist with the U.S. Department of Agriculture-Agricultural Research Service in the Plant Physiology and Genetics Research Unit at Urbana, Illinois. He serves as the curator of the USDA Soybean Germplasm Collection and is also an associate professor of plant genetics in the Department of Agronomy at the University of Illinois. His research program focuses on evaluating and utilizing soybean germplasm and developing methods for assessing genetic diversity.*



A key to gaining access to China's store of soybean germplasm is the recognition that new agricultural technologies are needed to improve the life of the country's rural population. One solution centers on the role of intellectual property rights in promoting exchanges.

## Chinese-U.S. Cooperation in Germplasm Enhancement

Donald A. Holt

IN LATE JUNE 1991, A PARTY CONSISTING of Harold Kauffman, Director of the International Soybean Program (INTSOY) at the University of Illinois; Lloyd Anderson and Ken Birkey, Illinois farmers representing the Illinois Soybean Program Operating Board; Don Latham and Dave Stone, Iowa farmers representing the Iowa Soybean Promotion Board; and I visited the People's Republic of China.

Our mission was to help plant breeders and geneticists gain access to the unique collections of soybean germplasm maintained by the Chinese. The many different varieties, lines, types of crops, crop ancestors, and crop relatives maintained in germplasm and genetics stock collections are the raw material from which plant breeders and geneticists develop the domestic crop varieties grown by farmers.

### The two germplasm collections

The U.S. National Soybean Germplasm Collection, an important repository for seed of domestic soybean varieties from all over the world, is maintained by the U. S. Department of Agriculture—Agricultural Research Service at the University of Illinois. The some 14,000 lines represented in the collection are well characterized and readily available to plant breeders and geneticists of all nations.

The Chinese soybean collection is maintained in Beijing and in some provinces by the Institute for Genetic Resources, a unit of the Chinese Academy of Agricultural Sciences. It is considerably larger than the U.S. collection but not as well characterized, categorized, or indexed. There are thousands of soybean lines in the Chinese collection that are not in the U.S. collection.

The Chinese collection, having come directly from the geographical center of origin of soybeans, may be more diverse than the U.S. collection. Among other unique features, it includes some 5,000 lines of wild annual soybeans that are close relatives of domestic soybean varieties.

### User fees

In our conversations with Chinese officials, it became clear that there were two major barriers to obtaining Chinese soybean germplasm for study and enhancement outside China. First, even though the Chinese have an excellent storage facility provided by the Rockefeller Foundation, they are unable to provide enough operating support to maintain, expand, or enhance the collection adequately. We sometimes have the same problem, although not to the same extent.

As one who has been more successful in fostering new facilities for agricultural research than in obtaining ongoing support for agricultural research operations, I fully understand the problem faced by those managing the Chinese collection. As we discussed this problem, we suggested to the Chinese that they might wish to consider charging modest user fees to those who requested samples from the collection.

### Intellectual property rights

The other major concern of the Chinese involved intellectual property rights. They recognize that the Chinese soybean germplasm collection and the germplasm as yet uncollected from the far reaches of China represent a national treasure. The Chinese agricultural research administrators feel obligated to manage that germplasm resource in a way that benefits the Chinese people.

They are not sure that giving the germplasm to other nations is the best way to manage such a valuable resource. At least, they reason, if they provide germplasm to other nations, they should be compensated in some way.

It is interesting that intellectual property rights are also becoming a major concern in germplasm exchanges in the United States. Scientists and administrators are becoming more aware that neither public institutions nor private firms are likely to invest much in developing and enhancing any resource, including germplasm, unless they can capture some proprietary benefit from that investment. When the resulting intellectual property is simply given away, it is difficult or impossible to achieve an adequate return on that investment.

### Terms of exchange

The recognition that the United States and China face the same germplasm exchange problems and concerns formed the basis for our discussions and informal negotiations with Chinese officials. Based on those discussions, I believe an exchange can be arranged, if people receiving the germplasm will agree to certain conditions.

Private or public plant breeders, geneticists, or others receiving Chinese germplasm should expect to pay a fee. The fees can be used by the Chinese to help offset the costs of managing and maintaining their germplasm collection.

The agreement will have to provide for intellectual property rights' protection for the Chinese. There is a relatively easy way to provide this, although we have not implemented this policy in our own germplasm collections. People receiving samples of Chinese soybean germplasm should sign a contract that includes the following provisions: 1) there should be no restrictions on the kinds of research and evaluation that can be performed using the materials; and 2) the person receiving the germplasm does not receive the right to commercialize the material or products deriving significant value from it.

Of course, people receiving germplasm should not pass the material on to others without written permission from the owners. Agreements such as this should be signed

not only by individual scientists but also by the responsible fiscal officers of institutions, agencies, and private firms by which they are employed.

If recipients develop and wish to market a product derived from the Chinese soybean germplasm, they should negotiate an appropriate license agreement, presumably involving royalties or other payments. This compensates the Chinese, who own the intellectual property, and, at the same time, provides the developer an opportunity to achieve a proprietary commercial position, thus justifying the investment in research and development.



*We need to deal with [the Chinese] in the same way we are now dealing with each other when we exchange valuable intellectual property.*



### Reaching an understanding

If the above arrangements can be made, I believe the Chinese will be willing to provide soybean germplasm for inclusion in the U.S. National Soybean Germplasm Collection or other repositories outside China. By these means, the germplasm can be made available to anyone who is willing to pay a fee, sign the appropriate agreement, and abide by it. What I described here is standard procedure for dealing with intellectual property rights in the U.S. private sector and increasingly in U.S. public institutions and agencies. It should not present a difficult adjustment for those who wish to study, enhance, and otherwise capitalize on access to Chinese soybean germplasm.

In summary, I believe Chinese officials can be persuaded to provide

valuable soybean germplasm for research and development in other nations, if their need for operating funds and their concerns about intellectual property rights are addressed. We need to deal with them in the same way we are now dealing with each other when we exchange valuable intellectual property. ☺

*Donald A. Holt is director of the Illinois Agricultural Experiment Station and associate dean in the College of Agriculture at the University of Illinois. Holt has previously served as president of the the American Society of Agronomy and is immediate past-president of the Agricultural Research Institute.*

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# A Global Perspective on Germplasm Exchanges

Harold E. Kauffman

**F**OOD CROPS ORIGINATED IN DIFFERENT parts of the world. As crops became a part of domesticated agriculture, they gradually spread outside their centers of origin. For example, rice, wheat, and corn, the three major food cereals, originated in Asia, the Middle East, and Central America respectively. Soybean, the world's leading oilseed and legume crop, originated and was first domesticated and used as a food in China about 5,000 years ago.

Soybean spread to Japan before the eighth century and into Southeast Asia before the sixteenth century. Soybean was introduced into Europe and North America in the eighteenth century but did not become a major crop until the twentieth century, when efficient oil extraction processing methods were developed and the demand for animal feed provided a market for the meal.

The genetic diversity of any crop is greatest at its center of origin, where genetic variability is introduced through natural outcrossing or mutations during each growing season. Therefore, over many growing seasons, thousands of genetically diverse plants have evolved.

During these many centuries, farmers have selected and grown plants with certain traits for specific food qualities, plant stature or duration, or tolerance to biological and environmental stresses. Many relatives to cultivated plants were not domesticated but continued to grow wild at or near the centers of origin.

In the early twentieth century, new scientific breeding methods permitted the planned manipulation or concentration of certain genetic traits into



China's soybean gene banks have thousands of varieties not represented in the U.S. collection. More importantly, many of these varieties come from the soybean's geographical center of origin and could provide essential genetic material for overcoming production and processing problems in the United States and the rest of the world.

relatively few cultivars. These cultivars had higher yield potential and, in some cases, better resistance to biological and environmental stresses than the traditional, or landrace, cultivars. As farmers began to grow these few varieties, many of the landrace cultivars were threatened with extinction.

## Collecting and preserving germplasm

In the early twentieth century, the U.S. Department of Agriculture (USDA) sent scientists overseas to collect seed that would broaden the diversity of cultivars available to U.S. scientists and farmers. In 1950, the USDA initiated the development of a comprehensive germplasm preservation system for crops traditionally grown in the United States.

During the last three decades, the global effort to collect and preserve germplasm of the major food crops has been spearheaded by the International Agricultural Research Centers

(IARCs), supported by the Consultative Group for International Agricultural Research (CGIAR), and the United Nations Food and Agricultural Organization (FAO). The CGIAR and FAO established the International Board for Plant Genetic Resources (IBPGR) in 1974 as the coordinating body to work with national and international organizations on collecting and preserving germplasm. The IBPGR germplasm network now has more than 100 gene banks responsible for preserving various agricultural crops.

## Status of soybean germplasm

Many of the soybean cultivars grown in the United States are based on germplasm collected in northeast China in the late nineteenth century and the early part of this century. Subsequent collections and exchanges with Korea, Japan, Taiwan, and several other countries have broadened the genetic base of the U.S. soybean industry.

Since China began opening relations with the outside world two decades ago, some additional soybean germplasm has been obtained from China. With the help of the Rockefeller Foundation, China has built a modern national gene bank in Beijing. In 1987 for the first time, China began transferring its soybean germplasm from the provinces to the long-term storage facility in Beijing. More than 17,000 cultivated soybean accessions and 5,000 wild soybean accessions are now in the gene bank. Many of these accessions are likely to have useful genes that can supplement those already in the U.S. collection.

### Germplasm networks in the "green revolution"

During the past three decades, the International Rice Research Institute (IRRI) in the Philippines and the International Center for Maize and Wheat Improvement (CIMMYT) in Mexico served as the catalyst for the "green revolution," which doubled the production and yields of rice and wheat in many developing countries. The "green revolution" was successful because participating scientists could systematically evaluate and freely use all of the world's best rice and wheat germplasm.

IRRI's gene bank now has more than 80,000 accessions of rice. Some 100,000 accessions of wheat are stored in gene banks at CIMMYT and in several other repositories managed by national programs. IRRI and CIMMYT also coordinate global networks, in which scientists from 75 to 100 countries regularly work together to make crosses, screen germplasm for special traits, and evaluate the adaptability of advanced breeding lines to a broad range of environmental conditions. This cooperation has resulted in the rapid development of cultivars with high yield potential, a wide range of maturities, resistance to biological and environmental stresses, and improved grain quality, to mutual benefit of farmers and consumers worldwide.

### Importance of soybean germplasm exchanges with China

Unlike the mandates for rice, wheat, and most of the other food crops, none of the IARCs has a global mandate to collect, preserve, systematically characterize, and use soybean germplasm. Although China has participated openly and actively as a partner in international germplasm networks for other food crops, the Chinese have had neither the incentive nor the international financial support to cooperate in soybean research with other countries on a multilateral basis.

Only small bilateral programs on soybean have been developed with a handful of countries. Therefore, a long-term collaborative research program on soybean germplasm between China and the United States is of paramount importance to both countries.

If adequate funds are available to support this program over a number of years, it will bring economic benefits to growers, processors, and consumers in the United States and China. It will help maintain the competitiveness of soybean in the world markets for protein meal and edible oil. It also will provide the opportunity for soybean to play an increasingly important role in meeting the food demands of health conscious Americans and in improving the nutrition of millions of people in developing countries. ☪

*Harold E. Kauffman serves as director of the International Soybean Program (INTSOY) at the University of Illinois. In that role, he oversees a cooperative research network that has established scientific contacts in some 100 countries around the world. Initially with the International Rice Research Institute in the Philippines and later with INTSOY, Kauffman has more than 15 years of direct experience working with China.*

## Soybean Germplasm: The National Treasure of China

Sun Huan

**M**UCH EVIDENCE SUPPORTS THE VIEW that the soybean is native to China. It is believed that only a small portion of the soybean germplasm collected in China is on the lists of germplasm kept outside the country.

Chinese call the soybean "Dadou" (great bean) or "Huangdou" (gold or yellow bean) and look upon it as a national treasure, simply because it has contributed greatly to the development of the Chinese nation and its civilization. It has served as one of the main protein sources in the Chinese daily diet for several thousand years.

### Benefits from China

The knowledge of the cultivation and utilization of this crop and the unique soybean genetic resources accumulated in the long history of China also have contributed greatly to the expansion of the soybean in other parts of the world, especially in the United States. Richard L. Bernard, a U. S. Department of Agriculture soybean breeder at the University of Illinois, stated in a history of the U.S. soybean industry that "the successful establishment of the U.S. soybean industry was based on the successful development of a similar industry of soybean production and oil extraction

in Northeast China. We owe a debt of gratitude to the unknown Chinese...."

Some problems, however, have accompanied the expansion of soybean production. Scientists are searching for genes resistant to diseases, insects, and environmental stresses and genes related to the improvement of quality. Chinese soybean germplasm, which has wide genetic variation and has not been well evaluated, attracts many scientists and farmers. Soybean cyst nematode once threatened soybean production in the United States. The resistant genes found in the soybean collection from China and other introductions have saved American farmers countless dollars.

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*Why don't we work together and share our findings, using the resources of Chinese soybean germplasm and U.S. technologies and research funds?*

~ ~ ~ ~ ~

## Need for mutual understanding

Nevertheless, complaints that China is not willing to exchange soybean germplasm freely have often been heard from the United States in recent years. Here we need mutual understanding. Since the mid-1970s, exchanges of scientists, research information, and soybean germplasm between China and the United States have greatly increased. The number of soybean collections from China keeps growing in the United States.

Of course, China has not yet completely opened its soybean germplasm to the outside world. We commonly consider our soybean germplasm as a national resource. Every country, including developed countries, has its own choice of policy to protect its special resources. Furthermore, there is serious concern that we may have to pay for technologies or products that contain our donations.

Soybean is an important cash crop in the United States. The United States has the technological and financial ability to achieve almost any goal, provided the proper genetic materials are available. On the contrary, the soybean is not the first priority crop in

China. The research funds allocated to it are not comparable to those in the United States. In other words, the ability to achieve our goals is limited even though we preserve a large amount of soybean germplasm.

## Working together

Why don't we work together and share our findings, using the resources of Chinese soybean germplasm and U.S. technologies and research funds? Cooperation between China and the United States will benefit both sides. An American soybean geneticist who worked on soybean genetic variations for half a year in China said that as long as one characteristic of the soybean is improved in the United States, all inputs for that work would be more than paid back.

Because of heavy population pressure and the emphasis on domestic markets, the Chinese soybean industry will never compete with that of the United States in world markets. On the contrary, further development of soybean production in China will stimulate the demands for deeper exploration of the soybean's genetic resources, which in turn will benefit American farmers. ☛

*Sun Huan serves as vice-president of the Jilin Academy of Agricultural Sciences and vice-chairman of the China Soybean Society. He served as co-chairman of the International Conference on Soybean Processing and Utilization held during 1990 in Jilin Province. His main research interest is the genetic variation of wild soybean (Glycine soja) germplasm in China.*



The Chinese regard their store of soybean germplasm as nothing less than a national treasure, the benefits of which must be passed on to future generations. With this essential understanding, the opportunities are increased for germplasm exchanges with the United States and other countries.

## A U.S. Farmer's Perspective

Lyle E. Grace

I STRONGLY BELIEVE THAT A GERmplasm exchange with China would be a real plus for U.S. agriculture. Research is truly the most important resource in developing varieties with better yields and greater disease resistance. We must back our researchers and look to germplasm exchange as a source of new varieties that will help us as farmers in the years to come. Most of all, we farmers cannot stand still.

The largest bank of soybean germplasm in the United States is located at the University of Illinois. But, the germplasm bank in China is even larger, representing a virtually untapped source of genetic diversity. Exchanging germplasm with China could open up countless new opportunities for research.



The soybean germplasm collection housed at the University of Illinois has long played an important role in promoting new research that has benefitted U.S. farmers. In the future, access to genetic material from China could be just as important in stimulating new research with huge potential benefits.

## New research opportunities

Researchers have done an excellent job over the years in keeping U.S. farmers supplied with new soybean varieties, but we need new and different germplasm to develop varieties that would be more resistant to drought and other adverse weather. More and more diseases are showing up in our soybeans. Again, new varieties developed through germplasm exchanges may hold the key to solving this growing problem.

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*What we need is a level playing field, not isolation from the rest of the world.*

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We also have hit a plateau in yields. To be competitive in today's global economy, U.S. farmers must produce more at a lower cost. This could require new varieties that would increase our yields by ten to twenty bushels per acre.

Many parts of the Third World need new sources of protein that are cheaper in cost. Researchers with the International Soybean Program (INTSOY) and the Department of Food Science at the University of Illinois have been working to meet this challenge. They have developed a wide array of soybean foods for human consumption, including soybean milk, green soybeans, and low-fat soy flour. Many of these products may benefit from the development of new specialty varieties.

There is also a great need for soybeans with enhanced oil and protein characteristics. Despite this need, we have had problems increasing the amount of protein and oil from our present soybean varieties. By exchanging germplasm, our researchers will have more opportunities to develop varieties that will increase both oil and protein. In addition, it would be helpful to develop soybean strains with better shipping qualities for the benefit of our overseas customers.

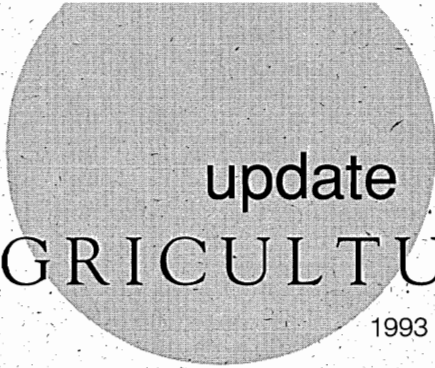
## Gains from germplasm exchange

In the past, some of our farmers have had grave concerns about exchanging germplasm with the rest of the world. They believed that such exchanges would make other countries more competitive with our farmers and thus we would lose some of our world soybean markets. I have never held this view. In fact, I am convinced that our farmers can out-produce any other country in the world given the same opportunities. What we need is a level playing field, not isolation from the rest of the world.

We as farmers have a lot to gain from international activities, such as the proposed germplasm exchange with China. It will take time to make the exchange and to develop the new varieties. Meanwhile, I would argue that it is imperative that we increase our investment in research aimed at giving the United States a competitive edge in developing better soybean varieties. We farmers will have to lead in making these efforts become a reality.

It is especially gratifying when new breakthroughs result from direct cooperation between farmers and researchers. We are grateful to the researchers and the farmers, who made the trip to China this past summer. They were instrumental in making the exchange possible. The results hopefully will benefit everyone.

*Lyle E. Grace is a soybean and corn farmer in rural Champaign County, Illinois. He is active in numerous farm organizations, including the Land of Lincoln Soybean Association and the Illinois Soybean Program Operating Board, and has received honorary life membership in the American Soybean Association. Grace currently serves on the International Agriculture Advisory Committee for the Office of International Agriculture in the College of Agriculture at the University of Illinois.*



# INTERNATIONAL AGRICULTURE

1993 Vol.7 No.1

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## Commercialization Project Begins in Egypt

Improving diets in Egypt with soy-enriched foods is a long-term goal of a University of Illinois International Soybean Program (INTSOY) project in Egypt. The two-year, \$1.2 million project is funded by the Egyptian National Agriculture Research Project through the U.S. Agency for International Development in Cairo.

INTSOY is helping establish a model commercial soybean processing pilot plant at the Egyptian Food Technology Research Institute (FTRI). The plant uses low-cost extrusion and mechanical expelling technology to produce high-quality edible oil and high-protein, low-fat meal. INTSOY and FTRI scientists will use the installation to help Egyptian entrepreneurs develop private operations.

"The plant will allow Egyptian businessmen to see and learn," explains Dr. Karl Weingartner, INTSOY food scientist. INTSOY will follow installation with seminars and workshops for plant managers.

soy products with bread to improve nutrition, particularly that of school-aged children."

Egypt's 56 million people are supported by only 6 million cultivated acres along the Nile River. Egyptian farmers grow soybeans, but because they currently produce only about 25 percent of their needs, imports will grow because there's little room for expansion. "We envision increased consumption of soybeans as human food and increased importing of U.S. soybeans to meet those needs," Weingartner says.

## Helping Establish Private Enterprise

The INTSOY project is an applied program that will assist Egyptian entrepreneurs.

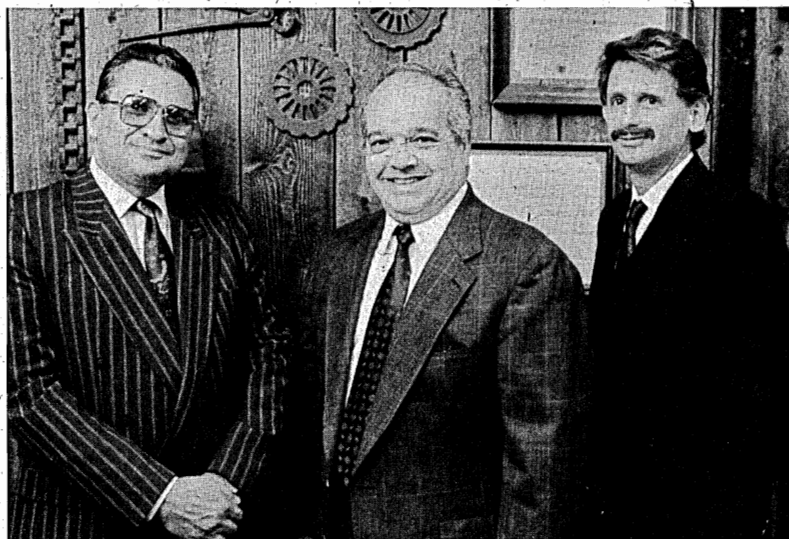
"INTSOY offers a number of strengths," Weingartner explains. "We have specific knowledge in developing new processes. We have experience in technical assistance that started in Sri (now Sri) Lanka in the 1970s. And we have an association with a major university that gives us the facilities, resources, and teaching expertise to make a program effective." ☺

## Feeding a Growing Population

The Egyptian diet depends on an unleavened bread for almost 70 percent of its daily protein and calories. Integrating high-protein soy flour into traditional Egyptian foods could provide products with high nutritional value especially beneficial to low-income groups.

"The population is growing," Weingartner says. "Per capita income is decreasing. People are poor. Meat consumption is very low. Bread is the most important component of the diet. Malnutrition is high, especially among school children. We want to investigate combining

Integrating high-protein soy flour into traditional Egyptian foods could provide products with high nutritional value especially beneficial to low-income groups.



While on the UIUC campus planning administrative details for the new Soybean Cooperative Technical Assistance Program, Ahmed M. Khorshed (left), director of the Food Technology Research Institute, Giza, Egypt, met with College of Agriculture Dean W.R. Gomes (center) and INTSOY scientist Karl Weingartner.

The key is that the process can be adjusted to vary the amount of oil in the meal.

## Public-Private Partnership Paying Off

The small central Illinois community of Congerville has become the demonstration site for new technology that is being introduced in equally small towns and villages around the world.

The product of a joint venture between the University of Illinois International Soybean Program (INTSOY) and Triple F, Inc. of Des Moines, Iowa, the facility turns raw soybeans into low-fat soy meal and soy oil.

INTSOY's mission is to improve human nutrition worldwide through the increased use of soybeans. An indirect benefit of this increased consumption will be a boost to international demand for the commodity that's produced in the U.S. and Illinois.

The INTSOY program includes research to develop technology and soy products for developing countries, training individuals about soybean technology and products, and providing assistance to help institutions and entrepreneurs obtain technology or establish process industries.



Wilmot B. Wijeratne, associate director of INTSOY (left), explains soybean processing equipment to Rep. Richard Durbin (second from left) and his administrative assistant, Mike Daly. INTSOY scientist William D. Savage is at the far right. A similar extrusion-screw press is being installed in Egypt.

"We do applied research with a target audience in mind," says Dr. Wilmot Wijeratne, associate director of INTSOY at the UI. "We generate technology and products through research."

The research component of INTSOY is carried out in facilities provided by the Department of Food Science and includes a research adviser from the department on a continuous basis.

In industrialized countries, soybean processing usually involves multi-million-dollar processing plants that use solvent-extraction to separate high-protein soy meal and soy oil. These plants, however, aren't practical in developing countries that have neither sufficient capital nor soybean production capacity to operate efficiently.

INTSOY's answer is an extruder-screw press combination that uses friction to generate enough heat to quick-cook the soybeans. The process yields high-quality soy meal and oil while destroying the components that interfere with soybean digestibility.

The meal can be milled into flour to supplement human diets or be used as a protein source for farm animals. The oil is extremely stable and meets the need for cooking oil in foreign countries.

The meal produced by the extruder-screw press process has important properties as livestock feed, Wijeratne explains. "It can contain bypass protein that has more nutrient value to ruminants," he says. "And it can be modified to provide a high-energy feed for swine."

The key, Wijeratne says, is that the process can be adjusted to vary the amount of oil in the meal. Temperature, pressure, and time are critical, and the final product is influenced by this combination.

The installation at Congerville features an extruder manufactured by Triple F, an international agribusiness company with operations in more than 70 countries.

Triple F joined INTSOY in a partnership when the development project moved from the pilot-plant stage to commercial scale. "The University lacked the finances and physical facilities to establish a commercial installation," Wijeratne explains. "This led to a partnership in the private sector."

Triple F was a logical choice because they manufactured the extruder that had been used in the pilot plant. And because they were already operating feed mills in the U.S., including the one

Although our goal was to develop technology for overseas, it soon found a demand in the U.S.

in Congerville, setting up a commercial-scale extruder-screw press system was a reasonable move. Triple F simply extended the building and installed new equipment and a handling system.

"The partnership between INTSOY and Triple F is now at a state at which we can offer developing countries a complete package of technology, including equipment, training, and help in setting up a commercial venture," Wijeratne says. "Without the partnership, it would have been impossible for us in the university to do this."

"We're getting more private-sector participants in our training programs," he adds. "When they see the pilot plant and train in it, they're interested in learning more. The facility at Congerville provides the next-step opportunity—a commercial model to

show full-scale operation and help them make business decisions."

In addition to helping expand export markets for Illinois soybeans, the project has also opened a new door of opportunity for American farmers.

"The technology has taken hold in this country," Wijeratne says. "Although our goal was to develop technology for overseas, it soon found a demand in the U.S. Already there are five commercial operations in the Midwest."

The small-scale extruders provide a local source of specially formulated feeds for dairies and swine operations. A side benefit is that they add value to a home-grown product and create nonfarming jobs in local communities. ☞

## Chinese Germplasm Arrives

**W**ithin two weeks of their arrival in early May, samples from 500 varieties of Chinese soybean cultivars had been planted. The arrival of the germplasm marked the success of the negotiations between Chinese and American researchers and government officials.

Dr. Randall L. Nelson, director of the USDA soybean germplasm collection, says that researchers are eager to move ahead as quickly as possible to analyze and evaluate the varieties. Although genetic evaluation is a protracted process, investigators want the financial investors and Chinese donors to see results from the exchange. "It's to everyone's advantage to see what is of use [in these lines]," Nelson says.

Researchers are investigating insect and disease resistance and seed composition: traits with short-term economic impact. Long-term, researchers will evaluate the general genetic diversity, looking for patterns associated with certain traits.

First the soybeans will be put through the "pure

line" process to make sure each cultivar is genetically pure. Researchers hope to link variations in certain genetic traits with specific regions in China. "We're hoping for lines that were genetically isolated for a long time," says Nelson. This may be important in the future if researchers need to know where to look for more plants with specific genetic traits.

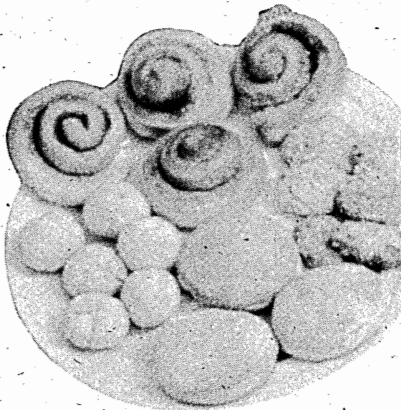
One of the researchers working with this material is Dr. Chen Yi Wu, an agronomist from the Chinese Academy of Agricultural Sciences, who has come to UIUC as part of the exchange. Chen is learning new genetic evaluation techniques as a visiting scholar in agronomy. Chen will return to China with his new research skills and some relevant analytical equipment.

Nelson is pleased with the response so far from researchers interested in working on this material. "These will be without a doubt the most thoroughly studied lines in our collection." ☞



Chen Yi Wu from the Chinese Academy of Agricultural Sciences is spending a year on the UIUC campus as a visiting scholar in agronomy.

Baked goods made with soy protein look and taste much as their non-soy-containing counterparts.



## International Research Unit Contributes To Breakthrough Feeding Study

**F**oods produced from new technologies developed by the University of Illinois International Soybean Program (INTSOY) may soon be influencing U.S. diets.

Recently announced results of feeding studies conducted by UI food scientists indicate that diets which include soy-containing breads and other baked goods could significantly reduce blood cholesterol levels for some people. The research was directed by Susan Potter, an assistant professor of foods and nutrition, and John Erdman, director of the division of nutritional sciences.

Twenty-five patients at the Veterans Affairs Medical Center in Danville, Illinois, volunteered for the study. Part of their diets included soy-containing breads, muffins, cookies, cakes, and fruit bars that included about 50 grams of soy protein per day. The soy products came in part from research conducted by INTSOY.

Two soy products were used in the feeding study. One was a soy protein isolate from a commercial manufacturer. The other was soy flour made by INTSOY's extruder/expeller process.

Because they have been developing soy-containing foods for many years, INTSOY researchers were called on to develop the products that would be used in the project. INTSOY kitchens were put to use testing and refining recipes for the baked goods that had to contain significant amounts of soy and still maintain an acceptable taste.

Once the recipes were perfected, INTSOY food scientist Dr. Karl Weingartner and INTSOY researcher Dr. William Savage worked with the staff in the College of Agriculture's large-scale kitchens

to assist in "scaling up" to produce large, commercial-level quantities of the products.

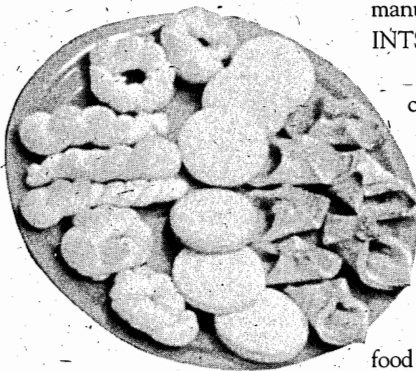
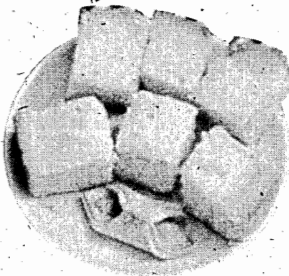
The final products were tested in a UI cafeteria. After follow-up surveys, the foods were deemed to look and taste like baked goods without soy additives — a key goal of the study.

"In previous work, people were placed on all-soy, liquid diets, or all animal protein was replaced in the diet with soy," Potter says. "It works, but not many people want to eat like that. We thought that if we could take soy products and add them to typical foods that people like to eat, it might be more palatable, something people could stick with."

Each patient began the study with a cholesterol level higher than 240 milligrams per deciliter and was put on a low-fat, low-cholesterol diet for two weeks. Then, every day for the next 16 weeks, each patient ate two 6-inch loaves of bread, two muffins, two cookies, a piece of cake, and a fruit bar, all baked and packaged by UI bakers.

The study included four treatments that changed at four-week intervals. One treatment used soy flour, the second used isolated soy protein and soy fiber, the third used isolated soy protein and cellulose (as a control fiber), and the fourth used nonfat dry milk (as the control protein) and cellulose. When they were used, the soy ingredients provided approximately 50 percent of the daily dietary protein.

Blood samples were collected following each treatment. Isolated soy protein was most effective, showing an average 12 percent drop in total cholesterol and an average 11.5 percent drop in LDL (low density lipoprotein) cholesterol. ☞



Diets which include soy-containing breads and other baked goods could significantly reduce blood cholesterol levels for some people.



## International Travel

From October 18 to November 26, Wilmot B. Wijeratne, Karl E. Weingartner, and Kukiari Tanteeratham, INTSOY, discussed implementation of the new Soybean Utilization Technical Program with officials of the Food Technology Research Institute in Egypt. Wijeratne then went to Ethiopia, Kenya, India, and Sri Lanka; Weingartner went to Ethiopia, Kenya, Zambia, and back to Egypt; and Tanteeratham went to India, Sri Lanka, Thailand, and Japan.

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Robert P. Bentz and Burton E. Swanson, INTERPAKS, and John W. Santas, International Agriculture (OIA), worked six weeks in China in October and November on the Agricultural Support Services Project reorganizing the agricultural extension system from the provincial to township levels. Bentz worked on the agro-technical extension system; Santas analyzed staff skill gaps and developed a training plan; Swanson coordinated their work with an Australian team on a similar assignment.

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## International Visitors

On September 18, 12 participants from the Russian-American Senior Farm Management Course visited campus for lectures on farm management by Earl R. Swanson and Robert H. Hornbaker, Agricultural Economics, and Robert K. Boesdorfer, Cooperative Extension. John W. Santas, OIA, arranged the visit.

• • • • •

On September 30, Hiroshi Hirata, faculty of agriculture, Tokyo University of Agriculture and Technology, Tokyo, Japan, discussed topics related to farming and ecology and sustainable agriculture with Robert G. F. Spitze and Robert H. Hornbaker, Agricultural Economics; Donald A. Holt, Agricultural Experiment Station; Donald G. White, Plant Pathology; F. William Simmons and Donald G. Bullock, Agronomy; and J. Kent Mitchell, Agricultural Engineering. John W. Santas, OIA, arranged his itinerary.

John J. Nicholaides III, International Agriculture, Roberto J. Garcia, Agricultural Economics, and William L. Flinn, president and CEO, MUCIA, met with University of Costa Rica and Ministry of Agriculture and Livestock officials about the forthcoming World Bank-financed Agricultural Sector Project from September 27 to October 2 in San Jose, Costa Rica.

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From November 29 to December 6, Burton E. Swanson, INTERPAKS, served as a member of an external review panel for CIAT, Cali, Columbia. For the first six months of 1993 Swanson is on sabbatical with the International Service for National Agricultural Research (ISNAR), The Hague, The Netherlands, where he continues work on research-extension linkages. Swanson participated in a World Bank-sponsored Pan-African Agricultural Extension Conference in Accra, Ghana, from January 17 to 24.

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Ahmed M. Khorshed, director, Food Technology Research Institute, Giza, Egypt, met with INTSOY staff from September 26 to October 2 to work out administrative details for the new Soybean Cooperative Technical Assistance Program.

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From October 22 to 24, an agricultural-education delegation from the People's Republic of China visited UIUC. The delegation consisted of Mao Daru, Wang Yunjiu, Ling Jianhui, Gao Jingqing, Sun Xinyou, Ministry of Agriculture, and Song Tianzhi, Chinese Academy of Agricultural Sciences. The group's itinerary was arranged by John W. Santas, OIA, and by the Chinese Students and Scholars Solidarity Union.

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A delegation from the Universidad Autonoma del Estado de Mexico visited campus from October 12 to 16. The group consisted of Jose Frias Diaz,

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director, faculty of engineering; Antonio E. Gomez Diaz, director, faculty of veterinary medicine; Jesus Hernandez Avila, director, faculty of agronomy; Octavio Castillo Pavon, director, faculty of urban and regional planning; Ezequiel Jaimes Figueroa, director, faculty of medicine; and Javier Sanchez Guerrero, director, Academic Interchange. They met with UIUC faculty in their respective academic fields as well as with Dean W. R. Gomes and Associate Deans William L. George and John J. Nicholaides III, College of Agriculture, to promote academic exchange and collaborative research. The visit was arranged by Isabel Wong, Overseas Projects and Foreign Visitors, and Roger E. Kanet, International Programs and Studies.

John J. Nicholaides III, International Agriculture, Munir H. Nayfeh, Physics, and Glenn E. Stout, Water Resources, attended a reception and luncheon for Jordan's Crown Prince El Hassan Bin Talal on October 16 in Chicago.

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On October 21, John J. Nicholaides III, International Agriculture, and John F. Rundquist, executive director, Illinois Agricultural Consortium, met in Springfield with Waldemar Pawlak, former Prime Minister of Poland and current President of the Polish Peasant's Party, to discuss possible collaborations. ☺

## Director's note

This issue of *International Agriculture Update* focuses on soybean utilization research at UIUC and on how the results of our research investments are aiding both our overseas partners and Illinois agriculture.

The UI Office of International Agriculture cooperates with federal programs, foreign governments, and domestic and foreign entrepreneurs to raise the standards of living in developing countries. At the same time, our work helps enhance markets for Illinois farm products.

Egypt, for example, needs to improve the nutrition of its growing population but has little room to expand its agricultural resources. The Soybean Utilization Technical Assistance Program, jointly developed between our International Soybean Program (INTSOY) and the Food and Technology Research Institute (FTRI) in Egypt, seeks to improve nutrition by introducing new food processes using soybeans and soy products. Enhancing Egyptian diets with soy foods increases the consumption of and demand for soybeans from the U.S.

International activities also expand markets for U.S. technologies as well as for farm commodities. The technologies required by developing countries for soybean processing, for example, have been developed and refined in research programs at UIUC. Without proper processing technologies, hungry people around the world would not be able to use effectively the farm commodities the U.S. produces and supplies.

One remarkable result of our work in creating soy foods for less-developed countries is how these products are finding their way into American diets. The soy foods that were used in the cholesterol studies reported in this issue were created to supplement diets in other parts of the world. But without those products and the processes we developed to turn them into palatable, healthful foods, we might not know as much about the cholesterol-lowering benefits of soy protein.

Another result of international agriculture research is how the technologies are finding their way into American industry and taking hold. For example, the extrusion-screw press processing system created for developing countries is experiencing an increasing domestic demand as American entrepreneurs and small businesses profit from international research.

We are proud of the results of our soybean utilization research and its positive influence on both the U.S. and other countries. We anticipate greater results to come as we cooperate with like-minded individuals and institutions across the globe to the benefit of all concerned. ☺

John J. Nicholaides III  
 Director, International Agriculture  
 Associate Dean, College of Agriculture  
 Assistant Vice Chancellor for Research UIUC

One remarkable result of our work in creating soy foods for less-developed countries is how these products are finding their way into American diets.

## INTERNATIONAL AGRICULTURE

College of Agriculture  
University of Illinois at Urbana-Champaign

1993 Vol.7 No.2

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Director's Note

## The Value of International Exchanges

By Donald E. Kuhlman

**M**y experiences during nearly two years at the North West Frontier Province Agricultural University (NWFP-AU) in Peshawar, Pakistan are enough to fill a book. My two-year assignment in the TIPAN (Transformation and Integration of the Provincial Agricultural Network) at the NWFP-AU began on January 15, 1992.

In brief, I'm a member of a three-person technical assistance team (reduced from five), and I'm assigned as "Continuing Education Specialist" to assist in the institutionalization and sustainability of an outreach (extension) component in NWFP-AU. In general, agriculture in the NWFP is dominated by subsistence farming. There are over 600,000 farms in the NWFP of which 95 percent are less than 25 acres. Two thirds are less than five acres. Only five million of the 25 million acres in the NWFP are in crops. Wheat, the number one crop in acreage, averages about 20 bushels per acre; maize about 23.

Although food supplies are adequate now (although there are many nutritional problems), one can only ponder what the situation will be in the future. To attain any degree of food security, agricultural production *must* improve just to keep pace with the increasing population.

The TIPAN Project has the potential to bring about positive changes to the teaching, research, and extension systems — and agricultural production. My experience these past 20 months would suggest there is every reason to believe that 144 Pakistanis receiving long-term training in the U.S. under TIPAN and returning with M.S. and Ph.D. degrees are going to have a tremendously positive influence on teaching, research, and extension programs.

## Experiences

This first year with TIPAN at NWFP-AU has been a positive experience for my wife and me. However, be forewarned that leaving family, friends, home, and country can be a little traumatic at first. Fortunately, Donna and I have managed to overcome early homesickness and culture shock and have enjoyed an incredible experience in the NWFP of Pakistan and Peshawar. Although the Pakistani culture, religion, geography, and climate are vastly different than Illinois, we've found Pakistanis to be just as hospitable as Illinois farmers!

Lest you get the idea that everything about an international assignment is all "glitter," be advised that the challenges are many. One needs to have patience, persistence (without being overtly pushy), go slow (avoid an overload of ideas), be positive (not always easy), offer praise to counterparts, and learn to adjust to frustrations. Frustrations? Yes! Work habits and intensity are much different in Pakistan than those of extension teachers and researchers in Illinois. In our system, good performance is rewarded. Programs in the NWFP are mostly top-down, with little or no input from local people:



Don Kuhlman's assignment in Pakistan includes working with many people who studied in the United States under the auspices of the TIPAN program. Pictured here are (left to right) Meera Khan, outreach specialist; Khas Bahadur Marwat, plant breeding and genetics; Kuhlman; Bashir Ahmad Mohmand, agronomy.

## Major projects managed by OIA training office

*Shri Lanka Soybean Development:* 1975-1981. Arranged more than 200 person-months of degree and short-term training for research and outreach personnel at U.S. and Asian region institutions.

*Ivory Coast Ministry of Agriculture:* 1975-1985. Arranged and supervised intensive English training at UIUC followed by master's degree study for 60 individuals enrolled at 20 U.S. universities.

*Zaire/INERA:* 1981-1985. 7 research scientists received English training at UIUC and were placed for M.S. degree study at 5 U.S. universities.

*Zambia Agricultural Research and Extension (ZAMARE):* 1982-1988. Supported 49 research and extension staff who completed degree programs at 11 U.S. universities and 84 Zambian scientists who completed short-term, technical training.

*NWFP Agricultural University, Peshawar, Pakistan (TIPAN):* 1984-present. Placed 144 participants for advanced-degree study in all agricultural disciplines at 35 U.S. universities and sponsored 54 professors and research scientists for post-master's or post-doctoral programs of three to twelve months.

*Egerton University/Kenya-Institutional Development for Agricultural Training (IDAT):* 1986-present. Placed 33 faculty members for advanced-degree study at UIUC and eight other universities and arranged short-term programs for 12 Egerton University administrators and support staff to work as "attachments" to their UIUC counterparts.

## Benefits

There are a host of benefits to be derived from an international assignment. Donor countries, institutions, contract staff, and recipients share problems and solutions to use as building blocks for bringing about institutional change. Organizations are strengthened. Tolerance and attitudes of people to each other are enhanced in a positive way.

From a personal perspective, I'm learning to adjust and adapt to situations that would have seemed catastrophic in Illinois. Patience, not one of my virtues, is being discovered. Flexibility is an absolute must. So what if the meeting starts an hour late! At least there *was* a meeting and people *did* attend. Meetings that might seem to be ineffective turn out to be positive to people and programs.

My Pakistan experience has reconfirmed my opinion that the U.S. land grant university system, with its outstanding teaching faculty, innovative researchers, and highly qualified extension field staff and subject matter specialists is the best investment of tax money ever made by legislators.

How does UIUC, as a whole, profit from faculty working abroad? For starters, I think those returning from assignments abroad will have a greater compassion for the lives of people who are less fortunate, which in turn can bring about a positive influence on our professional activities. We're likely

to think more globally about issues related to our areas of specialization.

Another perspective is that international assignments can be confidence-builders for institutions and staff. We're viewed as experts by our friends abroad. When positive changes occur as a result of our expertise, our personal and institutional reputations and stature are enhanced, not only abroad but at the highest level of our government as well.

## Observations

Today I'm a little more knowledgeable about geography, cultures, religions, agriculture, and living conditions in developing countries as a result of my Pakistan experience. Travel, new friends, and financial considerations can also be benefits of a foreign assignment.

Possibly, the greatest benefit is to see how the rest of the world lives. How lucky we are to live in America! ☺

*Donald E. Kuhlman is continuing education specialist and professor of agricultural entomology, emeritus, TIPAN/USAID, NWFP Agricultural University, Peshawar, Pakistan, and College of Agriculture, UIUC.*

## OIA Training Office Supports Illinois and International Students

International agriculture training has been prominent at UIUC since institution-building projects in India in the mid-1950s and in Sierra Leone in the 1960s. Training support in the Office of International Agriculture (OIA) was formalized in 1978 when Dr. John W. Santas joined OIA and assumed responsibility for the training programs.

As procedures became increasingly complex, the training office had to address a wide range of changes that affected international students. Pamela Woodard joined the office in 1990 as the most recent development specialist to help manage the increased workflow.

The training office places students in programs that range from short courses of a few weeks to longer-term graduate degree programs at selected

U.S. universities. It also helps arrange individual programs of short-term, non-degree, specialized training and prepares itineraries and schedules appointments for guests who spend several days on campus and want to arrange meetings with people in specific disciplines.

## Administering federal contracts

The training office primarily serves students who are funded by U.S. Agency for International Development (USAID) contracts for development assistance or institution-building projects. The office arranges educational programs for all the students served by a contract, whether they attend UIUC or other U.S. institutions.

One of the training office's challenges is finding



John Santas counsels many international students on the UIUC campus. Here, he confers with Antonia dos Reis Figueira, a visiting researcher from Brazil who is doing post-doctoral work in plant pathology.

## OIA to expand role with undergraduate students

The OIA training office and the Office of Academic Programs are working together to create and manage international student exchanges for the College of Agriculture.

For several years, the staffs of these offices have been working diligently to create the college's international undergraduate opportunities.

Although many opportunities already exist through the UIUC Study Abroad Office, there is a growing need for programs specifically tailored to agriculture students. In addition, the last few years have seen the emergence of many new international exchange programs.

Associate Dean William L. George and Assistant Dean Charles E. Olson in the Office of Academic Programs have developed programs in Japan and are working on new programs in Argentina, China, and France. OIA helped develop the program in Russia and is working on a new opportunity in the Netherlands.

In order to provide additional management support, the College is strengthening the connection between OIA and Academic Programs. Eventually, OIA will assume the overall coordination of student-related international activities.

Because of his experience, John Santas will spearhead these efforts beginning this fall semester. In addition to providing leadership and overall management, Santas will write grants and identify funding opportunities.

academic homes for all students entrusted to them. For example, the TIPAN program in Pakistan specifies that 60 percent of the students must attend schools outside Illinois, so the training office placed participants in 35 U.S. universities.

"We make an effort to place students in the best institution possible," Santas explains. "Over the years we've placed something like 300 students. We've worked with schools and advisors all across the United States."

"International agriculture offices at other campuses really help," Woodard adds. "We've built personal relationships with our counterparts across the country."

"Our responsibilities include arranging admission, monitoring student progress, and making sure student needs are met," Santas says. "Most land-grant universities have people who work with international students in similar programs. We work with counterparts on other campuses. They assist our students, and we take an active role in helping their students who are studying on our campus."

## Managing student placement

Student placement decisions often depend on an institution's reputation and faculty expertise as well as on a student's credentials. International students must be placed on campuses that have academic programs that satisfy their needs and have admissions requirements they can meet.

Admission to graduate programs is a competitive, complicated process, and international students studying in the U.S. face many hurdles. Some, like limited space in a program or passing the Graduate Record Examination, are the same that confront every student; others, like language proficiency, require a minimum mastery of English.

"Most U.S. universities have become proficient at evaluating transcripts from foreign institutions and comparing them with results from domestic universities," Santas says. "Foreign students must be well-qualified."

In USAID-sponsored programs, M.S. students normally are expected to complete their studies in 24 months, and Ph.D. candidates usually finish in four years.

"Sponsored students don't have financial constraints that require them to earn money," Santas explains. "Most of them have been taken off jobs at home and sent here to acquire specific knowledge. There's a position waiting for them to come back to, and their sponsors want them to complete their degrees as quickly as possible. One of our tasks is to encourage them to get their work done on time. They're on a fast track."

## Illinois benefits

"International students create a richer atmosphere on our campus," says Woodard, now a U.S. Foreign Service officer. "Only a small fraction of our American students get to study overseas. By having international students on our campus, more of our students have an opportunity to learn something about other countries, other cultures, and the world in general. These students are learning more than plant pathology or ag economics, they're also learning about our culture and our system of education."

"Many of our short-term international students stay with families during their time here," she adds. "Our students, faculty, and citizens learn from visitors—about other cultures, other ways of doing things, other ways of farming. The more we know about the world outside our borders, the better off we are. When you meet someone face to face, there's communication. You can accomplish more."

"Our faculty also benefit from having international students in their classrooms and laboratories," Santas says. "They develop long-term contacts and gain colleagues in other countries when their students have finished and gone home. U.S. universities have a distinct advantage over anywhere else in the world to supply higher education. Students from everywhere want to come here to study."

"USAID projects assist other countries with their development efforts and at the same time recycle foreign aid money into our local economy," he adds. "Nothing makes more sense from a foreign policy point of view than to have international students enrolled in our universities and learn all facets and aspects of life in the U.S. Then, they go home knowing more about us and with a positive attitude toward the U.S."

"The U.S. can sell higher education to other countries. It's a high-demand commodity. There are many students who want to come here for an education."

During 1992-93 College of Agriculture undergraduates studied for a semester or full academic year in the following countries:

Australia  
England  
Wales

Sweden  
France

Costa Rica  
Spain

## College of Agriculture faculty participate in international activities

Every year, a number of College of Agriculture faculty participate in international activities; some for short terms, others for longer periods. The following faculty spent one term or longer in international venues during the 1991-92 or 1992-93 academic years.

**Peter D. Bloome**, Cooperative Extension, was on sabbatical in New Zealand and Australia from July to December 1991. Bloome studied fundamental changes in extension, especially the relationship between extension and commercial agriculture.

**Mark B. David**, Forestry, was on sabbatical in Finland from August to December 1991. David worked with the Finnish National Board of Waters and the Environment on organic acids in lakes and forest soils.

**Sara U. Douglas**, Consumer Sciences, was on a year's sabbatical. From August 1992 to January 1993, she was a Fulbright scholar at Airlangga University, Surabaya, East Java, Indonesia. In February and March 1993, Douglas consulted for the Faculty of Business, Monash University, Melbourne, Australia. She was invited to lecture and consult in Malaysia, Singapore, the Philippines, and Thailand for the balance of the year.

**James F. Evans**, Agricultural Communications and Education, was selected 1991 Haydn Williams Fellow at Curtin University of Technology, Perth, Australia; from July through December 1991. The fellowship involved teaching, educational program development, communications research, staff development, and community relations.

**Harold E. Kauffman**, INTSOY, is on a change of assignment and location to India from January 1992 to January 1995. Kauffman is with Winrock International overseeing the establishment of a plant genetic resources bank.

continued on page 5

## College Expands International Education Opportunities

The summer of 1992 marked a milestone in the UIUC College of Agriculture as a group of undergraduates spent eight weeks at St. Petersburg Agricultural State University in Russia.

"It changed my outlook on the world," says Brian Stauffer, a senior from Mahomet. "Before my trip I thought I had an appreciation for what the best of the world was like. Now, I realize there's so much more about the world I should know."

Stauffer was one of nine agriculture undergraduates who went to Russia or Japan for eight- and ten-week programs. Seven more students participated in similar activities this year.

Because some students are reluctant to be away from campus for semester-long or year-long programs, the college has begun to offer more short-term opportunities for international experiences according to Charles E. Olson, assistant dean for academic programs.

### Traditional programs

Traditional study-abroad programs take students for a semester or a full academic year and immerse them in a foreign culture while they pursue a full course load in a host institution. This is an exciting and enriching experience for many students who continue to study in their major fields and at the same time learn more about another culture, history, and perhaps a foreign language.

"This year, we sent 11 students on a study-abroad program for the entire academic year or for a semester," Olson says. "But without strong language skills, students can't fully participate in a full-term education. That limits them to English-speaking countries or countries with languages commonly taught in American schools; usually not Russia, Japan, China, eastern Europe, or Asia."

### Alternative opportunities

Shorter-term programs such as the trips to Russia and Japan have provided affordable, effective alternatives.

Tours also have generated student interest. For the past three years, Duane Erickson, emeritus professor of agricultural economics, has conducted a spring-break trip to the Caribbean. And the

International Agricultural Student Association has sponsored similar trips to such countries as Mexico and Costa Rica. Last spring, six undergraduate and six graduate members of the International Agricultural Student Association traveled to Jamaica for 11 days with two faculty advisers.

"We were fortunate to have financial help from within the college and from outside sources," says Patricia Libbra, a senior from Gillespie, citing assistance from the offices of International Agriculture, Academic Programs, and Resource Development and many college departments.

### Progress continues

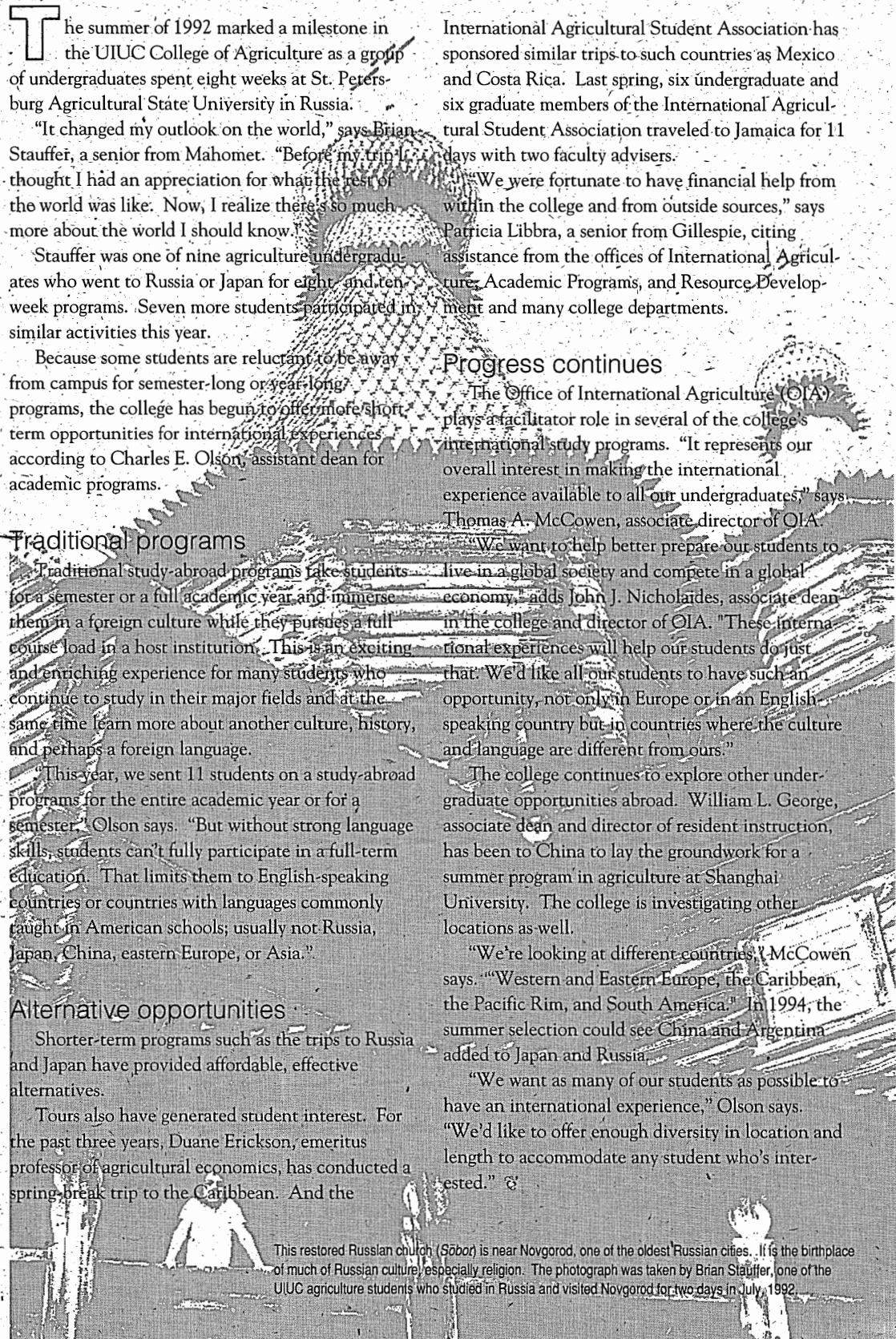
The Office of International Agriculture (OIA) plays a facilitator role in several of the college's international study programs. "It represents our overall interest in making the international experience available to all our undergraduates," says Thomas A. McCowen, associate director of OIA.

"We want to help better prepare our students to live in a global society and compete in a global economy," adds John J. Nicholaides, associate dean in the college and director of OIA. "These international experiences will help our students do just that. We'd like all our students to have such an opportunity, not only in Europe or in an English-speaking country but in countries where the culture and language are different from ours."

The college continues to explore other undergraduate opportunities abroad. William L. George, associate dean and director of resident instruction, has been to China to lay the groundwork for a summer program in agriculture at Shanghai University. The college is investigating other locations as well.

"We're looking at different countries," McCowen says. "Western and Eastern Europe, the Caribbean, the Pacific Rim, and South America." In 1994, the summer selection could see China and Argentina added to Japan and Russia.

"We want as many of our students as possible to have an international experience," Olson says. "We'd like to offer enough diversity in location and length to accommodate any student who's interested."



This restored Russian church (Sobor) is near Novgorod, one of the oldest Russian cities. It is the birthplace of much of Russian culture, especially religion. The photograph was taken by Brian Stauffer, one of the UIUC agriculture students who studied in Russia and visited Novgorod for two days in July, 1992.

Faculty cont. from page 4

**Guillermo A. Mendoza**, Forestry, was on sabbatical in the Philippines from January to June 1992. Mendoza collaborated with the Ecosystems Research and Development Bureau on yield projection and ecological assessment, and with the College of Forestry, University of the Philippines, he developed a management game model for contract reforestation.

**Archie R. Portis**, Agronomy and USDA, was on sabbatical leave to the Australian National University, Canberra City, Australia, from August 1991 to July 1992. Portis studied the mechanism of the enzyme rubisco which initiates the fixation of carbon dioxide into sugars during photosynthesis.

**Stephen C. Schmidt**, Agricultural Economics, received a Fulbright grant to the University of Agriculture, Plovdiv, Bulgaria, from February to July 1993. He taught courses and seminars related to agricultural economics.

**Robert M. Skirvin**, Horticulture, traveled to New Zealand and Melbourne, Australia, from September 1991 to June 1992. Skirvin learned new techniques of gene transformation and shared his own expertise.

**Mary Ann Smith**, Horticulture, traveled to the University of Lausanne, Switzerland, from August 1991 to February 1992. Smith studied intensive bioreactors in plant cells, using machine vision to extract pigments that may replace synthetic food colorings.

**Burton E. Swanson**, INTERPAKS, was on sabbatical with the International Service for National Agricultural Research (ISNAR), the Hague, the Netherlands, for the first six months of 1993. Swanson was continuing work on research-extension linkages. ☞

## International Visitors

On October 21, 1992, the College of Agriculture hosted the International Fellows from the National Defense University, Washington, DC. The group included John C. Fryer, Richard L. Smith, Steven J. Fred, and Elizabeth Davis, USA; Vicente Garcia, Spain; Luis Carlos Guedes, Brazil; Mehmet Hosder, Turkey; Ferenc Kalmar, Hungary; Wlodzimierz Miszalski, Poland; Jose R. Olivar, Venezuela; Eng Boon Soon, Singapore; Mohamed A. Tolba, Egypt; Lamine Cisse, Senegal; Jasem Al Jasem, Kuwait. The Fellows met with W. R. "Reg" Gomes, Dean; Donald H. Holt and Mary Scott Miller, Agricultural Experiment Station; William L. George and Warren K. Wessels, Academic Programs; Bruce M. Chassy, Food Science; William D. Savage, INTSOY; Anton G. Endress and Robert M. Skirvin, Horticulture; Roscoe L. Pershing and Steven R. Eckhoff, Agricultural Engineering; and John J. Nicholaides, International Agriculture.

Alhagy Cherno Jagne, private sector training specialist, Banjul, the Gambia, and Catherine Wanjiku Ngahu, Department of Business Adminis-

tration, University of Nairobi, Nairobi, Kenya, visited campus January 27 to 29. Both are conducting research on small business development centers as visiting researchers at the Wharton School of Business. They met with Pamela E. Woodard and Thomas A. McCowen, International Agriculture; Gary Shaw, Agricultural Experiment Station; Thomas N. Trone and Carolyn M. Sands, Commerce and Business Administration; and Thomas J. Bassett, African Studies.

Visiting scholars from the Food Technology Research Institute, Giza, Egypt, have begun training with INTSOY under the Soybean Utilization Technical Assistance Program. Azza Mohamed Hassanein arrived in January to spend two years as a M.S. candidate in Food Science. In February, Ali Ibrahim-Sayed Ahmed arrived to work for one year as a postdoctoral fellow with INTSOY on processing as it affects the nutritional properties of soybeans. Magdy El-Agaimy visited UIUC on February 18 before going to the National Center for Agricultural Utilization Research in Peoria to begin a one-year postdoctoral fellowship. ☞

## International Travel

Leslie Christianson, Agricultural Engineering; Carl Nelson, Agricultural Economics; and Uriel Kitron and Carl J. Jones, Veterinary Pathobiology, received grants from the Office of International Agriculture's Project Development Travel Fund. They will travel to various countries to develop collaborative research projects: Christianson to Western Europe for a project on microenvironmental control; Nelson to Cameroon for a project on econometric models of household consumption; Kitron to Kenya for a project on tsetse flies and trypanosomiasis; Jones to China for a project on fifth fly management. Grants are awarded twice a year by the Office of International Agriculture to support travel directly related to new project development.

Orville G. Bentley and John J. Nicholaides III traveled to Peshawar, Pakistan, in December 1992. They met with USAID, NWFP Agricultural

University, and Pakistan government officials to discuss the sustainability of the NWFP Agricultural University following the 1994 completion of the TIPAN Project. Various individuals who traveled to Peshawar in early 1993 to work on the TIPAN Project include: Jane S. Johnson and Rodney J. Fink, International Agriculture; Peter D. Bloome, Cooperative Extension; Donald A. Holt, Agricultural Experiment Station; Roscoe Randell, Extension Entomology; and Stephen Ries, Plant Pathology.

In mid-March, Lowell D. Hill, Agricultural Economics, and Karl E. Weingartner, INTSOY, traveled to Egypt to develop an economics project with the National Agricultural Research Project. Weingartner also monitored the progress of the Soybean Utilization Technical Assistance Program between the Food Technology Research Institute and INTSOY.

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International Travel cont. from page 5

Wilmot B. Wijeratne, INTSOY, spent April 4 to 7 in Hull, England, for technical discussions on the extrusion-screw pressing process at the invitation of De Smet Rosedowns Limited.

• • • • •

In early May, John J. Nicholaides III and Wilmot B. Wijeratne, INTSOY, traveled to Rome, Italy, to meet with FAO officials to discuss INTSOY involvement in the regional soybean networks of FAO/UNDP. Wijeratne then went to Manila, the Philippines, to discuss INTSOY participation in the FAO/UNDP Accelerated Soybean Development Project.

Karl E. Weingartner, INTSOY, participated in a soybean workshop in Harare, Zimbabwe, in mid-May.

• • • • •

Wilmot B. Wijeratne, INTSOY, spent late May developing a joint project proposal with the National Center for Soybean Research, EMBRAPA, Londrina, Brazil. From May 29 to June 2 he discussed technical assistance to introduce extrusion/screw pressing into an existing project with Planta Soyavyn, Lourdes, El Salvador. ☺

## Director's Note

Since it was established nearly 27 years ago, the Office of International Agriculture's broad mission has comprised institution building, research projects, and international study opportunities. We continue to focus on these areas as we increase emphasis on international opportunities for our students.

While it may seem strange for a Midwestern land-grant institution to be a U.S. leader in international development activities, it has been increasingly important during the past quarter century to reach beyond the borders of the United States. Our agricultural economy requires an increased understanding of and participation in world markets for our products. In the university, two of those products are students and knowledge.

One way we increase our level of knowledge is through research or exploration. And learning about other cultures — how they practice agriculture and how they interact with our agricultural system — can be beneficial to our local economy and the world economy as well.

When we joined with five other U.S. land-grant institutions to help India create an improved agricultural education and research system, our unqualified success did not go unnoticed. Dean Rusk, secretary of state for presidents Kennedy and Johnson, later called that work "the most successful piece of foreign policy ever implemented by the United States in its 200-year history." That success led to more institution-building projects such as the ones we now lead in Pakistan and Kenya.

Institution building involves more than just bricks and mortar; it also includes developing people as

researchers, teachers, and extension workers. We've done this by hosting international students and scholars in our college and by placing others in similar institutions around the country. By helping other countries develop their educational, research, and extension institutions, we also help develop their economies and their positions as international trading partners.

Along with bringing international students to our campus, our international programs have provided us with the opportunity to send members of our faculty to foreign locales. While they're there, our faculty teach and study; they also learn and bring back what they've learned to use in their own classrooms. Certainly, our college and our students benefit from our faculty's international experience.

Our students also benefit when they have opportunities to travel personally to foreign destinations and learn first-hand about the people and practices of the lands they visit. For some students, these experiences include full terms of study. For others, their budgets and curricula allow for only shorter experiences. During the past few years, the Office of International Agriculture has worked closely with the Office of Academic Programs in the College of Agriculture to arrange short-term opportunities to give our undergraduate students those important chances to see the world and world agriculture. This activity will continue to draw our emphasis because their futures—and ours—will benefit. ☺



## INTERNATIONAL AGRICULTURE

College of Agriculture  
University of Illinois at Urbana-Champaign

1994 Vol.8 No.1

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## Director's note

In November 1993, the Office of International Agriculture was pleased to have Dr. Mark D. Wilson, chief of Agriculture and Rural Development, Division IV, Latin American and Caribbean Region of the World Bank, present a special seminar entitled "The World Bank in Agricultural Development and Links to the University of Illinois" to college faculty, staff, and students as well as the International Agriculture Advisory Committee.

This presentation was especially significant because Dr. Wilson, a native of Scotland, earned his doctorate in animal science from the UI College of Agriculture in 1975.

The story of how Mark Wilson came to the University of Illinois College of Agriculture is captivating for a number of reasons. First, he originally came to Illinois not to go to school but to learn about the United States and work on a farm operated by John and Marge Albin near Newman, Illinois.

It was while he was working for the Albins that Mark Wilson came to know the University of Illinois through the Albins' encouragement. He stayed and enrolled in the College of Agriculture, successfully earning his doctorate.

Then Dr. Wilson went to work for the World Bank and became an extremely successful manager. In fact, he has just been selected as one of the

World Bank's Mid-Career Fellows for four months' study at the Woodrow Wilson School of Public and International Affairs at Princeton University. He places much of the reason for his success on the University of Illinois and the U.S. graduate education system, which he calls the "best in the world."

Dr. Wilson is only one example of how the University of Illinois College of Agriculture reaches into nearly every corner of the world; only one of many UIUC graduates who have made a positive impact in international agriculture. But the UIUC influence isn't limited to graduates who have earned bachelor's, master's, and doctorate degrees. Many of our short course alumni have returned to their home



Two visitors from Egerton University, Kenya, were on the UIUC campus November 14-16, 1993, to meet with UIUC officials. Pictured above are (left to right) Thomas A. McCowen, associate director, Office of International Agriculture, UIUC; W.R. Gomes, dean of the College of Agriculture, UIUC; Japhet C. Kiptoon, vice chancellor, Egerton University; Michael Aiken chancellor, UIUC; Christopher A. Onyango, deputy vice chancellor for academic affairs, Egerton University; and John J. Nicholaides III, director of the Office of International Agriculture, UIUC. Kiptoon and Onyango were on the UIUC campus to review the Egerton-UIUC program of collaboration that has been continuing since 1986. Kiptoon and Onyango's U.S. itinerary included attending the annual meeting of the National Association of State Universities and Land Grant Colleges in Washington, D.C., and visits to other universities with which Egerton has cooperative programs.

countries and inspired improvements in their agricultural programs — whether in extension, soybean utilization, or other fields.

We're proud of the contributions that the Office of International Agriculture has made to the well-being of Illinois citizens and other peoples of the world. From the Caribbean to Africa to the Indian sub-continent, American technology and American management help eliminate the gap

between subsistence agriculture and economic development. As world-wide standards of living improve, so does the market potential for Illinois farm products and services. . . a win-win situation if ever there were one. ☺

*John J. Nicholaides III  
Director, Associate Dean, and  
Assistant Vice Chancellor for Research*

## International Agriculture Short-Courses Serve Worldwide Student Body

**T**he UIUC College of Agriculture's Office of International Agriculture annually serves scores of students and guests who come to the Urbana campus from around the globe.

In addition to full-time students and visitors who come to campus for only a day or two, the Office of International Agriculture (OIA) provides a variety of short-term, non-degree, specialized training opportunities. Among them are a group of short-courses presented by the OIA's International Program for Agricultural Knowledge Systems (INTERPAKS) and the International Soybean Program (INTSOY).

INTERPAKS short-courses are developed and presented to help extension professionals from developing countries improve their skills in the transfer of knowledge from research scientists to farmers' fields.

INTERPAKS director Burton E. Swanson explains that there are "at least a half dozen extension approaches" around the world to reach rural people. INTERPAKS's goal, he adds, is to help extension professionals choose the approaches that suit them best.

"We've studied how extension is done around the world," Swanson explains. "So we use this information and teach our students to use this cafeteria of ideas from everywhere in solving their specific problems. Our courses emphasize process skills for managers."

INTERPAKS conducts short-courses for subject-matter specialists, extension administrators, mid-career women extension managers, and senior communications specialists.

Programs designed for subject-matter specialists generally focus on on-farm research methods as well as communications and training skills. These technical specialists learn how to serve as intermediaries between researchers, the extension field staff, and farmers.

Courses for administrators present information on diverse subjects such as management information systems, financial management, leadership, and other skills that are required of effective managers on the national, regional, and state levels.

"We're targeting senior-level people who can make a difference," Swanson says. "Programs for women managers are designed to prepare them for leadership roles in extension."

"Finally, a new course being planned for 1994 aims to help get extension's message across to farmers as well as to policy makers and other national leaders," he adds.

INTSOY's program focuses on improving human nutrition around the world through the increased use of soybeans in the human diet. Although much of INTSOY's work is in processing and utilization research, it also uses short-courses as part of its technology transfer activities.

During 1993, INTERPAKS and INTSOY sponsored several short-courses on the Urbana campus.

INTERPAKS training included:

- "Egyptian On-Farm Research and Extension" short-course was conducted from July 9 to August 6 for 15 adaptive research managers from Egypt.

- “From Research to Extension to Farmers: A Short-Course for Crop Management Subject-Matter Specialists” was held from July 15 to August 20 for 12 subject-matter specialists from Cameroon, Egypt, India, and Pakistan.
- “Improving Extension Management: A Short-Course for Extension Administrators” was presented to 22 extension directors from September 7 to October 13. Participants came

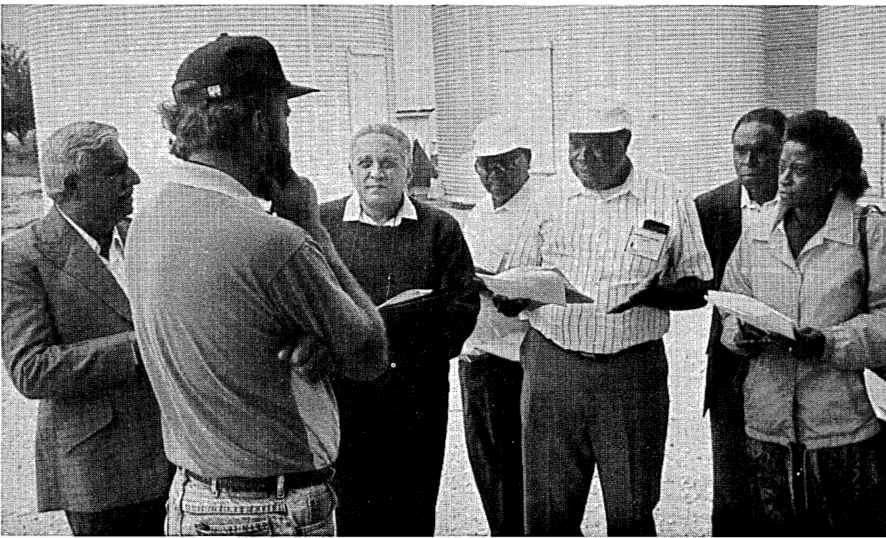
from Ghana, Egypt, Kenya, Nigeria, Pakistan, Tanzania, Uganda, and Zimbabwe.

In addition, two short-courses were conducted especially for extension communications specialists from Egypt. The first “Egyptian Extension Methodology and Communications Short-Course” was conducted for 18 participants from October 22 to November 19. The second was conducted from January 21 to February 20, 1994 for 12 participants.

INTSOY presented one short-course and sponsored two tours during the year.

The short-course “Soybean Processing for Food Uses” was conducted from June 23 to July 22. The 19 participants came from Bulgaria, Ecuador, Egypt, Jamaica, Malawi, Nigeria, Philippines, Sudan, Turkey, Uganda, Vietnam, and Zambia.

INTSOY conducted two observational tours as part of a soybean utilization cooperative technical assistance program with Egypt. The first tour, for eight private-sector participants, visited the UIUC campus and operating processing plants from July 6 to 27. The second tour for scientists was held for 13 participants from September 28 to October 19.



In addition to classroom sessions, short course agendas include field trips such as this one to a farm in central Illinois. Trips such as these allow participants to examine U.S. agricultural practices first-hand as well as observe farm life in rural America. These trips bring us closer to the global village by offering Illinois citizens the opportunity to interact with and learn from people from other lands.

## 1994 short-courses

### INTERPAKS

- “Improving Crop and Livestock Management for Senior-Level Subject-Matter Specialists” July 10 to August 11, 1994
- “Improving Extension Management for Senior-Level Extension Administrators” August 28 to September 29, 1994
- “Improving Extension Management for Mid-Career Women Extension Managers” October 9 to November 10, 1994
- “Improving Organizational Communications for Senior-Level Managers or Specialists” November 27 to December 16, 1994

### INTSOY

- “Soybean Processing for Food Uses” June 6 to July 7, 1994

For more information about any short-course, contact the Office of International Agriculture, University of Illinois at Urbana-Champaign, 109 Mumford Hall, 1301 West Gregory Drive, Urbana, Illinois 61801, U.S.A.

## INTERPAKS Publication Comes in Paper and Electronic Versions

### Digest goes electronic

*INTERPAKS Digest* also is available throughout the world to anyone who has a computer and modem or who has access to the Internet.

The INTERPAKS electronic data bases include previous issues of *INTERPAKS Interchange* and *INTERPAKS Digest* along with bibliographic citations and other articles dealing with extension methods, agricultural education, agricultural communications, extension organization and management, and rural sociology.

Several data bases and an electronic bulletin board are available via direct long distance telephone or via the Internet. The service is also offered through a "gopher" server at the USDA and through the Illinois Dial-up Extension Access (IDEA) network at (217)244-5185.

Access is free except for telephone charges.

A new approach to communicating with extension personnel throughout the world is being introduced by the University of Illinois College of Agriculture.

*INTERPAKS Digest* provides a new concept in communications by combining a traditional paper newsletter with electronic access to information important to the international agriculture community. It's the brainchild of Robert P. Bentz, senior adviser with the UI's International Program for Agricultural Knowledge Systems (INTERPAKS).

After 30 years with the University of Illinois, Dr. Bentz retired in 1992 as associate director of the Illinois Cooperative Extension Service. He now serves part-time as editor of the *Digest*.

*INTERPAKS Digest* is targeted at agricultural extension professionals around the world. "Of particular interest are those who help transfer technology and raise standards of living in developing countries," Bentz says. "The *Digest* is intended to be a vehicle that permits practitioners worldwide to become aware of new extension methods and to gain insights about agricultural development."

"There are about 600,000 extension workers worldwide and about 16,000 in the United States," Bentz says. "We want the *Digest* to be useful to them and those who work with them."

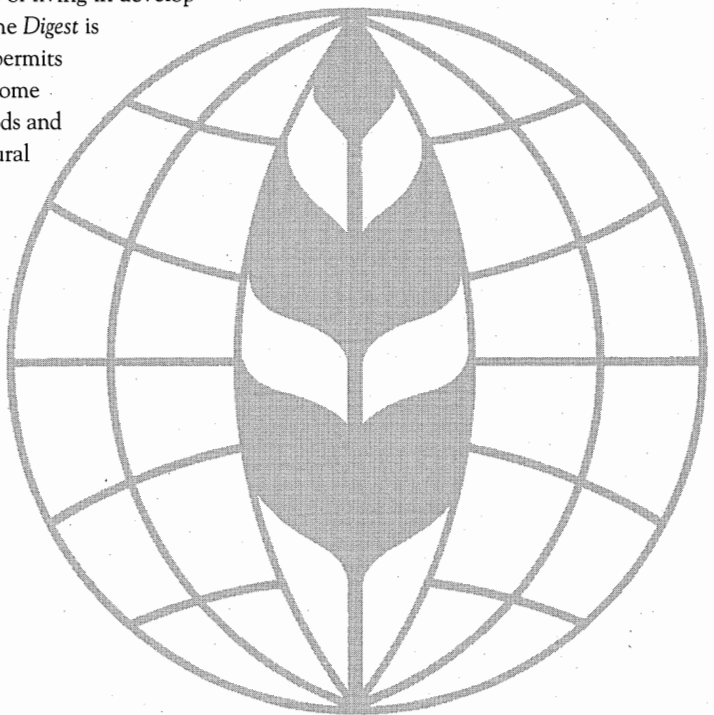
Bentz emphasizes the importance of the domestic audience as well. "What's happening in Brazil, China, or other countries affects the United States. One of our goals is to help U.S. extension professionals and their audiences better understand the international agricultural arena."

"INTERPAKS, its logo, and its publications are known throughout the world

— by donors like the World Bank, the United Nations Food and Agriculture Organization, and the U.S. Agency for International Development; by practitioners in many countries; and by researchers involved with technology transfer projects," Bentz says.

"We want to be able to provide information to anyone who wants it anywhere in the world," he adds. "But it's expensive as well as slow to mail material around the world."

Bentz started *INTERPAKS Digest* with a start-up grant from the Illinois Cooperative Extension Service. The publication is delivered by subscription to professionals in developed countries and is available free to practitioners in developing countries. Bentz's intention is to have the publication become self-sufficient within four years. ☺



## Student Commends Short-Course

“It was like a mini UN,” is how Jacqueline Phipps describes attending the INTSOY short-course “Soybean Processing for Food Uses” on June 23 to July 22, 1993 on the UIUC campus.

Phipps is a scientific officer who works in quality control, research, and product development for edible oils. She is employed by Caribbean Products Company, Ltd. of Kingston, Jamaica, a manufacturer of cooking oils, margarine, and shortenings.

Firsthand reports from others of conditions in different areas of the world helped Phipps discover that many problems are similar everywhere.

---

“There may be many different languages and foods, but we’re all in same boat.”

---

“We’re all trying to find protein sources and improve diets for those below poverty,” she says. “There may be many different languages and foods, but we’re all in same boat. I was really surprised by the diversity of uses for soy meal.”

A graduate of the University of the West Indies with a bachelor’s degree in chemistry, Phipps came to the short-course to seek “help with my present job as well as new fields that might be of relevance to my colleagues.”

“I expected to make contacts in my field,” she explains. “I hoped the course would put me in touch with a lot of people who had extreme expertise in my field. I came with questions to put.”

Phipps was looking for people who could help with problems, who would know about new

techniques and materials, who could tell her where to find and how to get the information she was looking for.

“The course was useful, but the real thing is contacts,” Phipps explains. “I didn’t want just course materials but channels, links, ways to make the information work.”

Phipps says she values the contacts she had with representatives of commercial organizations, including those outside the soy processing industry. She also enjoyed the opportunity to have encountered people with whom she already had professional dealings with but never actually met.

Phipps was particularly pleased to have met Kathleen Warner, a USDA researcher at the National Center for Agricultural Utilization Research in Peoria, and following up with her later.

“This course doesn’t end with me,” Phipps explains, adding that her role back in Jamaica will include giving reports and presentations to others in her organization.

Phipps is especially interested in new techniques in quality control and in using sensory evaluation as a tool. “I want to convince management to put resources into these areas,” she says. “I also want to establish library and documentation center.”

Because her employer is part of a group of companies, Phipps will serve as a facilitator. “What I can’t use personally I will give to others,” she says.

The INTSOY short-course was a “great experience,” Phipps says. She adds that she enjoyed the opportunity to learn about the American culture.

“Being back on campus brought back good memories,” she says. “Everybody was helpful and accepted you just like that; someone they never met. I really experienced America. The people were so nice, so accommodating.”

“I’d definitely recommend it as a worthwhile experience,” she says of the INTSOY course. “I’d encourage it, in fact.” ☺

## Project Development Travel Fund Awards Announced

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**E**ight members of the College of Agriculture faculty were awarded funding for international development projects during this academic year. Three awards were made through the International Agriculture Project Development Fund in the November, 1993 competition and five awards were made in the March, 1994 selection.

Joseph W. Stucki, Department of Agronomy, received a grant for \$1,000 and John A. Juvik, Department of Horticulture, and Lowell D. Hill, Department of Agricultural Economics, were each awarded \$500 grants last fall. Spring grants were made to Robert M. Skirvin, Department of Horticulture, for \$700; Burton E. Swanson, Office of Agricultural Communications and Education and INTERPAKS, and Michael E. Irwin, Office of Agricultural Entomology, \$400 each; Reed W. Larson, Division of Human Development and Family Studies, \$350; and Melvin M. Wagner, Department of Agricultural Economics, \$250.

Stucki will work to establish and solidify exchange agreements between the UI and six European institutions. The expected result will be the recruitment of outstanding European students to study soil chemistry at the UI, to provide opportunities for College of Agriculture students to study at the European institutions, and to encourage faculty exchanges.

Juvik will work with Dr. Zamir of Hebrew University in Jerusalem to develop a \$300,000 proposal for mapping and introgression of genes from the wild tomato species *Lycopersicon hirsutum* into tomato cultivars to improve their natural host-plant resistance to insect pest and inhibit weed competition.

Hill's grant will be used to develop an undergraduate international research internship in

Thailand for the summer of 1994. The program for advanced undergraduate students will include data collection and personal interviews with industry, government, and universities. The focus is grain markets in Thailand.

Skirvin will travel to Bucharest, Romania to establish a formal research program between Romania's Horticultural Biotechnology Laboratory and UIUC and develop joint grant proposals. He also will travel to Angers, France to work with the French government's fruit breeding station to develop grant proposals.

Swanson and Irwin will travel to the West Bank to develop a proposal with colleagues at Berzeit University to design and implement a small-scale integrated pest management demonstration project for selected crops. The project would involve farmers as well as research and extension institutions in the West Bank and Gaza and possibly Egypt.

Larson's grant will be used for travel to Egypt to work with the International Council on Alcohol and Addictions to develop a research project focusing on adolescent substance abuse in Egypt, Saudi Arabia, Sudan, Morocco, Lebanon, Italy, and the United States.

Wagner will travel to China to consult with representatives of two universities and two institutes to develop collaborative relationships between UIUC and these institutions.

Proposals selected for support by the International Agriculture Project Development Fund are evaluated and recommended by an anonymous faculty selection committee. College of Agriculture faculty may obtain application forms from their department offices or from the Office of International Agriculture, 109 Mumford Hall. ☛