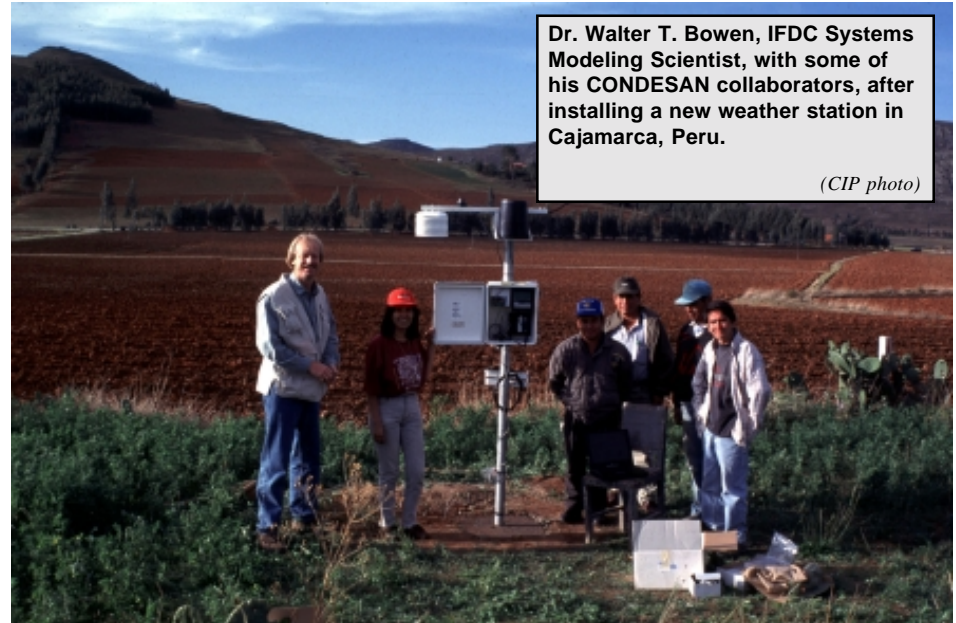


*an update on
the work & progress at the
International Fertilizer Development Center*

**IFDC
Collaborates With
the Consortium
for the
Sustainable
Development of
the Andean
Ecoregion
(CONDESAN)**

The complexity of Andean agriculture is shaped not only by differences in the physical environment such as topography, altitude, climate, and soil but also by differences in the cultural and economic environment such as government policy and access to credit and markets. To better understand how these differences influence the sustainable development of the region, an innovative consortium of scientists, policy makers, and development specialists was formed in 1992. This consortium, known as CONDESAN (Consortium for the Sustainable Development of the Andean Ecoregion), links public and private sector partners in research, training, development, and policy making to promote the protection of natural resources and improvements in welfare and equity for the people of the Andes. With more than



Dr. Walter T. Bowen, IFDC Systems Modeling Scientist, with some of his CONDESAN collaborators, after installing a new weather station in Cajamarca, Peru.

(CIP photo)

75 institutions as members, CONDESAN has a wide range of research and development projects underway at sites in Bolivia, Colombia, Ecuador, Peru, and Venezuela. IFDC has been an active participant and contributor to CONDESAN since 1996 when it stationed one of its systems modeling scientists, Dr. Walter T. Bowen, at the International Potato Center (CIP) in Lima, Peru. CIP is the convening center for CONDESAN, providing a consortium coordinator, deputy coordinator, and financial accounting services.

One important activity of the CONDESAN research agenda emphasizes the development of integrated assessment tools that help quantify the economic, environmental, and health tradeoffs in agricultural systems. Recently, a preliminary version of the Tradeoff Decision Sup-

port System (DSS) was developed with financial support from the USAID Soil Management Collaborative Research Support Program (SM-CRSP) and The Ecoregional Fund managed by the International Service for National Agricultural Research (ISNAR). Based on a rigorous modeling approach that blends several scientific disciplines, the Tradeoff DSS is software designed to support policy decision making by a variety of stakeholders, including politicians, agricultural and environmental research planners, and development specialists. The Tradeoff DSS also provides a framework for guiding disciplinary integration and its contribution to policy analysis.

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IFDC is a public, international, nonprofit organization, governed by an international board of directors with representation from developed and developing countries. The Center is supported by various bilateral and multilateral aid agencies, private foundations, and national governments. IFDC focuses on increasing and sustaining food and agricultural productivity in developing countries through the development and transfer of effective and environmentally sound plant nutrient technology and agribusiness expertise.

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"The Tradeoff DSS integrates georeferenced soil and climate data with the DSSAT suite of crop growth simulation models, econometric-based economic simulation models of land use and management decisions, and environmental process models such as pesticide leaching and soil erosion models," Bowen says. "With the software, we can draw a statistically representative sample of fields in a region such as a watershed, conduct integrated analysis, and statistically aggregate the results to a scale relevant to policy decision making. The software then allows us to display the tradeoffs between competing or complementary policy objectives in simple two-dimensional graphs, showing how these tradeoffs might change under alternative policy and technology scenarios."

The Tradeoff DSS represents an approach to modeling agricultural production that accounts for both the spatial and temporal variability of the physical environment and farmer decisions on crop choice and management. The development of this approach is based on the recognition that it has not been possible to conduct environmental impact analysis with the regional or national units of analysis typically used by economists. Whereas economists use aggregate constructs such as market supply and demand, analogous constructs are not typically used in the physical and biological sciences. For instance, economists typically use equations representing the regional or national demand for inputs such as pesticides and fertilizers to estimate how their use would change in response to, for example, a price change.

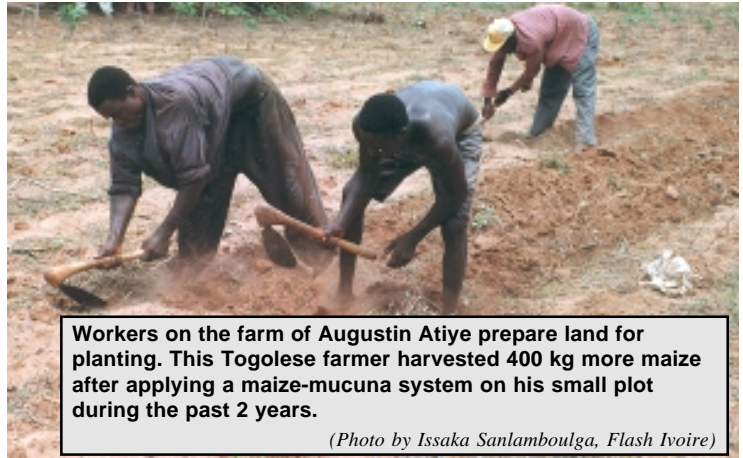
However, from the soil science perspective, it would not make sense to assume only one soil type to predict the impact of management on yield, soil organic matter levels, or other environmental impacts at a regional or national

level. Rather, soil scientists would disaggregate the study area into units of analysis with recognized soil types and other geophysical characteristics and estimate yield and environmental impact for each of these units. The approach followed in the Tradeoff DSS is to disaggregate the economic analysis in a manner compatible with the soil science analysis, estimate economic and environmental impacts at that disaggregate scale of analysis, and then aggregate impacts to the regional or national level needed for policy analysis.

"The Tradeoff DSS provides a framework in which constraints to sustainable agriculture are being assessed in the Andes," Bowen says. "For example, tradeoff indicators that are now being analyzed include value of crop and livestock production, soil productivity and water quality, and human health. The constraints being addressed include reductions in soil productivity associated with soil erosion and soil compaction, losses in nutrients, impacts of management practices on water quality, and impacts of pesticide use on human health. Scenarios for enhancing the long-term sustainability of Andean production systems include improved soil management and conservation practices, pest management practices and integrated pest management (IPM), improved crop varieties, improved pasture management, and farmer training to improve the safety of pesticide use and farm machinery practices."

Collaborators in the development and application of the Tradeoff DSS include CIP, IFDC, CONDESAN, the National Agricultural Research Systems of Peru (INIA) and Ecuador (INIAP), several non-governmental organizations, and universities in Peru and Ecuador, Montana State University, Wageningen Agricultural University, and the Research Institute for Agrobiological and Soil Fertility (AB-DLO) of The Netherlands.

Fertilizer and Sustainable Agricultural Development Project Holds Promise for West Africa



Workers on the farm of Augustin Atiye prepare land for planting. This Togolese farmer harvested 400 kg more maize after applying a maize-mucuna system on his small plot during the past 2 years.

(Photo by Issaka Sanlamboulga, Flash Ivoire)

To help small farmers escape the vicious cycle of poverty and over-exploitation of natural resources, IFDC-Africa is convinced of the need for an increased use of chemical fertilizers. However, the price, the low efficiency of chemical fertilizers, and often the lack of profitable outlets for agricultural produce are some of the primary constraints that limit the adoption of chemical fertilizers.

The Fertilizers and Sustainable Agricultural Development (F&SAD) project, supported by the International Fertilizer Industry Association (IFA), is a research and development project that aims to strengthen linkages between farmers, fertilizer dealers, extension workers and researchers in order to increase fertilizer use and to improve its efficiency. The F&SAD project starts at the grassroots level. It is executed by IFDC-Africa, in close cooperation with various partner institutions, such as governmental organizations (national agricultural research and extension services) and nongovernmental organizations.

The F&SAD project, under the direction of Dr. Arnoldus J. Maatman, Head of IFDC-Africa's Input Accessibility Program, aims at removing these constraints through a combination of measures. "One measure that we are using is the promotion of soil amendments through the improvement of the rate of organic matter such as green manure, agroforestry, and crop residues; the phosphorus capital including phosphate rock and soluble phosphatic fertilizers; and soil pH (dolomite),"

Maatman says. "Another avenue that we pursue is the promotion of the methods of maintaining soil fertility at more intensive levels of agricultural production through an optimum combination of mineral and organic fertilizers. We also use the promotion of complementary methods to improve the productivity of land, labor, and capital. Support for the development of farmer organizations to help to improve access of both male and female farmers to credit and external inputs such as fertilizers and tools provides another means of accomplishing our goal. Support for the development of local and regional markets through the training of traders, transporters, and other current and potential stakeholders in the private sector is another important means of removing the constraints."

The use of a technological package comprising soil amendments, the methods of soil and water conservation, integrated fertilization technologies and other farming practices is called Integrated Soil Fertility Management (ISFM). The whole package that includes all socioeconomic efforts is referred to as a Soil Fertility Improvement strategy.

Improvement of soils is a long-term process. Thus, it is necessary to convince both farmers and donors to invest for a sufficiently long period. This becomes easier through demonstrating the effectiveness of the proposed approach. To avoid the problem of the two parties quickly losing their interest, it is necessary to begin where the soils are partially prepared. Several fam-

ers in the villages to be selected have already been intensively using amendments such as phosphate rock and/or the sources of organic matter.

"The project's target group is composed of small farmers, not large industrial agricultural producers," Maatman says. "The number of villages has increased from 4 villages in 1996 and 1997 to 10 villages in 1998 - 5 in Togo, 3 in Niger, and 2 in Benin. The number of participants, including both male and female farmers, increased from 120 to about 250."

Maatman is beginning to see positive results through the project. "During the first three years the F&SAD project concentrated on the identification of pilot zones and target groups. Participatory diagnosis of nutrient flows and analysis of prospects for and the constraints to agricultural intensification were also implemented. Rural communities experimented with ISFM techniques. Managers and executives from research and development institutes received training. Revolving funds managed by farmers themselves and the organization of open field days in the villages are other activities that have been undertaken."

Maatman and his collaborators have realized substantial increases in nutrient recovery and crop yields by using the ISFM package. In the southern region of Togo, the ISFM package resulted in an almost triple nutrient recovery rate compared with that from depleted soil. The

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yield increase that was realized from the ISFM package was 1,800 kg/ha as opposed to 650 kg/ha from the depleted soil.

What is needed in most situations is not a simple process of incremental adaptation to actual circumstances nor an inward looking strategy based on local resource management. Increased market integration must be emphasized. Such a process involves many actors, all of which must invest time and money to make soil fertility improvement a reality. First, farmers must invest in external inputs and should allocate resources to adopt the ISFM technologies. Traders, transporters, and manufacturers should invest in local sales points of external inputs, fabrication of agricultural equipment, and processing of agricultural products. Governments should invest in public infrastructure, education, and facilitation of the investment in these activities by private sector actors. Proper legislation and control mechanisms and specific well-targeted sectoral investments are needed; these include agribusiness development and appropriate credit programs. Governments and donor institutions should invest in soil fertility recapitalization.

Training Program Focuses on Using Computer Models to Simulate Crop Growth

"Before I retire I want to transfer my knowledge (of crop models) to young people and researchers in the crop research division so that they can carry on the modeling work," says Dr. Andries Lourens du Pisani, Senior Agricultural Researcher, Ministry of Agriculture, Water and Rural Development of Namibia. "This training program has updated my knowledge of the latest modeling tools and also use analysis tools that are associated with crop models."

Pisani was one of 13 participants from 12 countries to attend IFDC's international training program on "Computer Simulation of Crop Growth and Management Responses," conducted at Headquarters during May 17-28. The countries represented included Argentina, Austria, Dominican Republic, Guyana, India, Italy, Mexico, Namibia, Nigeria, Trinidad and Tobago, United States, and Vietnam.

Computer simulation models of the soil/crop/atmosphere system can make a valuable contribution to both furthering the understanding of the processes determining crop responses and predicting crop performance in different areas. With the increasing availability of personal computers, user-oriented simulation models greatly facilitate the task of optimizing crop and nutrient management and deriving recommendations concerning crop management. They also can be used to investigate environmental and sustainability issues of agroecosystems.

The crop models and associated analytical tools used in the course are constantly being adapted as scientific knowledge increases or demand for analytical capabilities



Dr. Upendra Singh, IFDC Senior Systems Modeling Scientist, assists a participant in applying a simulation model to a cropping system during a hands-on session in the training program on "Computer Simulation of Crop Growth and Management Responses."

(Photo by Charles E. Butler)

increases. In recent years, the models have become more modular in nature, allowing a more open framework for model development and improvement. Recent changes include improved routines for water and nitrogen, the addition of a phosphorus sub-model, and optional organic carbon routines for studying long-term crop rotations. A second major thrust in improving model capabilities is the linking of the biophysical models to spatial analysis through integrated GIS systems. This allows applications using the crop models to go beyond site-specific cropping recommendations and expand predictive capability to the watershed or country level to be used as a tool in strategic planning and crop forecasting.

The participants in the training program learned practical approaches to simulating the effects of soil, climate, management and pest factors and their interaction with the input needs of crops. Faculty members, including scientists from IFDC, the Universities of Florida, Georgia, and Guelph and international agricultural research centers, demonstrated the simulation of the processes of crop growth and development; water use; uptake of nutrients; and response to

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irrigation, fertilizer, and other management decisions. In "hands-on" practical sessions using personal computers, the participants applied simulation models to cropping systems in various regions of the world.

Before enrolling in the course, Pisani had participated in the development and use of a maize model in Namibia. He employed the maize model so that he could recommend base planting dates for the crop and because using a model is more effi-

cient than conducting several experiments. "I now have more confidence using the models and testing them under the Namibian conditions," Pisani says.

Unlike Pisani, Diógenes E. Pérez, Technical Manager (Fertilizers), Fertilizantes Santo Domingo C., Dominican Republic, had no prior experience with crop models. "I now understand how crop models can help me to better advise farmers," Pérez says. "In this training program we learned that nitrogen is the nutrient that is very important

in increasing crop production. I believe that I can now simulate crop production and determine the rates of nitrogen that are best for achieving high yields of my countries' primary crops—rice, maize, and tomatoes. Because 60% of the nitrogen consumed in the Dominican Republic is used on rice, application of the rice model would prove very beneficial for my company since 45% of our business comes from rice."



IFDC's Outreach Division Director, Jorge R. Polo, addresses an international workshop on current environmental issues of fertilizer production, held in Prague, Czech Republic.

(Photo by Ludwig G.F. Schatz)

IFDC conducted an international workshop on current environmental issues of fertilizer production in Prague, Czech Republic, during June 7-9, 1999. Cosponsors of the workshop included the European Fertilizer Manufacturers' Association (EFMA), the International Fertilizer Industry Association (IFA), The Fertilizer Institute (TFI), the United Nations Environment Programme (UNEP), the United Nations Industrial Development Organization (UNIDO), and the United States Agency for International Development (USAID).

This workshop was the fifth in a series of environmental workshops that IFDC has conducted over the past 8 years. The first workshop, "Conference on Ecologically Sustainable Industrial Development," was held in Denmark in 1991. In India the Center conducted the International Workshop on the Environ-

mental Impact of Ammonia and Urea Production Units during 1991. In 1992 IFDC conducted the International Workshop on Phosphate Fertilizer and the Environment in Tampa, Florida (U.S.A.). In 1993 the International Workshop on the Environmental Issues of Nitric Acid-Based Fertilizer Production and Farm-Level Use was held in Belgium. During 1997 IFDC conducted in Atlanta, GA (U.S.A.) an International Workshop on Environmental Challenges of Fertilizer Production - An Examination of Progress and Pitfalls.

Seventy-four delegates from 28 countries attended the workshop; they represented many different types of organizations such as fertilizer-producing companies, design and engineering entities, mining facilities, research institutions, governmental and nongovernmental organizations, manufacturers' associations, regulatory bodies, cooperatives, agricultural concerns, and private consultants.

A keynote address, delivered by the President of The Fertilizer Insti-

Environmental Workshop Conducted in Prague, Czech Republic

tute (TFI), Gary D. Myers, indicated that by working as a group rather than as individual companies, the fertilizer industry has a greater chance of reaching sound stewardship practices for the future. Mr. Myers also stated that the fast pace of electronic communications through the Internet make it more important and necessary to keep abreast of all issues that relate to fertilizer production and the environment. He indicated that in the United States the regulators are now beginning to address the environmental issues affecting the industry through the "risk assessment" method rather than with the "best available technology" method used until this time. With this new method they assess the risk that particular substances pose to either human health or the environment. He indicated that environmental trends are no longer national or regional in nature and that what begins to be regulated in one place will likely affect regulations in others in a short period of time.

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The workshop dealt with various technical subjects. Some of the subject areas that were focused on during the workshop included:

1. Industry overview and specific environmental issues in Central and Eastern Europe;
2. Pollution prevention and waste minimization;
3. Environmental and quality management systems;
4. Technical assistance, training, and communication for improved environmental stewardship;
5. Environmental codes of conduct and stewardship through engineering and technology; and
6. An examination of the broader issues.

During the six sessions 28 technical presentations were made by international specialists, covering different topics within these broad subjects. At the end of the workshop, the participants voiced their concerns for the future and made recommendations to improve the environmental aspects related to fertilizers. IFDC is now preparing the proceedings of the workshop, which should be published in a few months.

New IFDC Albania Project Focuses on Assisting Albanian Agricultural Trade Associations

Albania's future lies in fostering the potential of its nascent private entrepreneurs through the development of the agribusiness sector as a market-driven engine of economic growth. IFDC is conducting a new project, which is being sponsored by the U.S. Agency for International Development (USAID), to meet the needs of private Albanian entrepreneurs in agribusiness. In so doing, the project directly helps achieve USAID's objective of developing prosperous private enterprises that stimulate widespread and solid economic growth.

The Assistance to Albanian Agricultural Trade Associations (AAATA) project has twin goals - to build networks and systems that promote and support agribusiness development, specifically trade associations, sources of capital, policy reform and technical advice; and to assist individual agro-enterprises to catalyze new ventures and expand and modernize existing ones.

Chief of Party, Claude Freeman, who is managing this project in Albania, understands the importance of trade associations in the development of a progressive agribusiness sector. "Trade associations are critical for coalescing the critical mass

that can advocate effectively for liberalization of the market and enforcement of standards and rules," Freeman says. "Without concrete examples of agribusiness success, potential members will not have the incentive to join and invigorate trade associations; and providers of credit and capital will remain reluctant to open their doors to agro-based newcomers. It is the agro-processors who will generate the pull effect on agriculture that will help 'commercialize' smallholder farmers."

The AAATA project concentrates on four key areas - trade associations, individual technical assistance, access to capital, and effective food standards. Together these efforts will significantly help meet the specific needs of the agribusiness community. A few examples of the types of assistance that the AAATA project is providing Albanian entrepreneurs follow.

The project has assisted the Mireli dairy processing firm in procuring modern packaging equipment from a Slovenian firm; this has improved significantly the firm's market and allowed diversification in its prod-

(Continued on page 7)

A worker in an Albanian dealer's shop checks products for sale. Nascent private entrepreneurs in Albania are receiving assistance through the AAATA project as they build prosperous businesses.

(Photo by Larry Klaas, AGCOM International, Inc.)



(Continued from page 6)

uct line. More Albanian dairy firms are now interested in this packaging technology.

The project has also facilitated contracts between the Shpiragu fruit and vegetable firm and 50 farmers in the Berat district to plant 30 ha

of wine grapes, which allows the firm to diversify into wine production.

By making trade connections for AIBA - a livestock feed and poultry firm - the project arranged for the direct purchase from a company located in Hungary of 200 tons of soybean meal for the production of livestock feed.

These are just three examples of the many instances where IFDC specialists stationed in Albania are making a difference by helping to develop strong private enterprises and hopefully a solid economy in the future.

Recent IFDC Publications

Privatization and Deregulation: Needed Policy Reforms for Agribusiness Development

IFDC and Kluwer Academic Publishers recently copublished a proceedings document entitled *Privatization and Deregulation: Needed Policy Reforms for Agribusiness Development*, which was edited by Dr. Surjit S. Sidhu, IFDC Principal Economist (retired), and Dr. Mohinder S. Mudahar, Principal Economist, the World Bank. An international symposium, organized by IFDC, provided a unique opportunity to discuss needed policy reforms to promote efficient and competitive agribusiness development, with a particular focus on privatization and deregulation. The seminar was a response to the challenges and opportunities to acceler-

ate agribusiness development resulting from the economic transition to a market economy. This publication should prove useful to policy makers, institutions, and other stakeholders involved in formulating strategies for reforming agriculture and agribusiness in the transition and developing economies. Privatization and deregulation are critical for promoting efficient agriculture and agribusiness. Innovation, creativity, and cost-effectiveness are difficult to achieve in a controlled policy environment. Soft-bound copies of the publication are available from IFDC; interested parties can order the publication from the IFDC Purchasing Department by requesting IFDC-SP-26, which is priced at US \$50.00

Estimating Rates of Nutrient Depletion in Soils of Agricultural Lands of Africa

Overcoming chronic problems that lead to degradation of agricultural land in Africa requires a good un-

derstanding of the interplay among biophysical, agroclimatic, economic, and human factors that determine the management of natural resources and prevailing farming systems. The findings of a recent IFDC study have been published as a technical bulletin entitled *Estimating Rates of Nutrient Depletion in Soils of Agricultural Lands of Africa*, prepared by Dr. Julio Henao, Senior Biometrics Scientist, and Dr. Carlos A. Baanante, Director, Research and Development Division. In the publication current rates of nutrient depletion in soils of agricultural areas of Africa are estimated to identify and characterize regions where the nutrient mining of soils is becoming a factor in land degradation and a primary constraint to the sustainable intensification of agricultural production. Estimates of the amounts of nutrients required to balance inflows and outflows of

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International Fertilizer Development Center 1999 Training Calendar

Training Program/Study Tour	Dates	Location
International Workshop on Current Environmental Issues of Fertilizer Production	June 7-9	Prague, Czech Republic
Advances in Agricultural Production and Fertilization	July 12-23	U.S.A.
International Workshop and Study Tour on Compound Fertilizer Production and Bulk Blending	August 9-20	U.S.A.
International Fertilizer Marketing Training Program	September 6 - October 1	U.S.A.
International Fertilizer Marketing Training Program	November 29 - December 10	Dubai

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nutrients and thus prevent nutrient depletion are provided as useful indicators for the design of soil and fertilizer management strategies that can be adopted to prevent land degradation and increase production. The development of nutrient depletion indicators relies on the use of cross-sectional (spatial) and time series data. Methods, procedures, and computer programs to

estimate nutrient flows and balances were developed, tested, and adapted from previous studies. Estimates of nutrient depletion are analyzed in the context of prevalent circumstances such as current levels of crop production, inherent soil fertility conditions, and resilience (for fragility) of the soils, biophysical and agroecological environment, and population density. Scientists working on agronomic problems associated with soil fertility, decision

makers interested in crop production and fertilizer use, and policy makers interested in the environmental implications of soil degradation will find this publication useful. To order this publication, IFDC Technical Bulletin, T-48, please send your request to the IFDC Purchasing Department. The price of the bulletin is US \$50.00.

Announcements

Channing A. Sieben joined IFDC recently as Chief of Party-Albania and is posted in Tirana. He directs the project entitled "Sustaining the Restructured Fertilizer Subsector in Albania." Sieben previously worked with IFDC as a consultant on the Albanian and the former Soviet Union projects. His areas of expertise include small business management and marketing, the seed industry and agribusiness, and association development. Claude Freeman shifted to the "Assistance to Albania Agricultural Trade Associations" project as chief of party.

Dr. Richard A. (Dick) Morris joined IFDC recently as a Research Management Expert for the Agricultural Research Management Project in Bangladesh. Dr. Morris is seconded to IFDC from Virginia Tech University. Prior to accepting this assignment, Dr. Morris served as Director, Production Systems Program and Soil Scientist, the Asian Vegetable Research and Development Center and in various capacities with Oregon State University and the International Rice Research Center.