International Fertilizer Development Center
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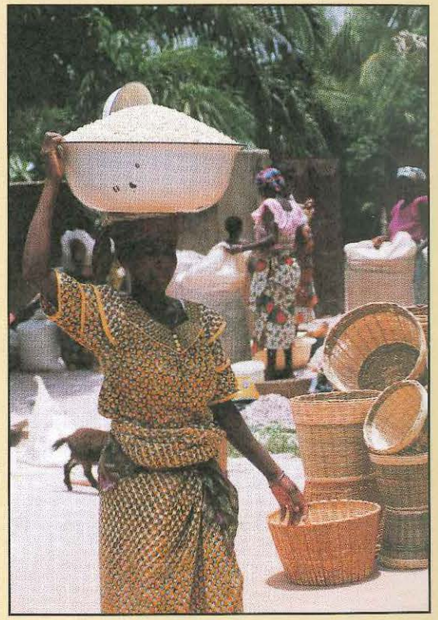
IFDC Corporate Report 2000/2001

International Fertilizer Development Center

IFDC Profile

IFDC is a public, nonprofit, international organization dedicated to conduct its work independently and on a scientifically sound basis. IFDC was founded in 1974 to help in the quest for global food security. The Center's goal is increasing agricultural productivity in a sustainable manner through the development and transfer of effective, environmentally sound plant nutrient technology and agricultural marketing expertise. The Center has conducted technology transfer activities in more than 120 countries. IFDC has contributed to the development of human resources and institutional capacity building in 150 countries through more than 600 training programs. Its cadre of scientists and professionals provide a unique mix of applied research and technology transfer capabilities. The Center's facilities include libraries, laboratories, greenhouses, pilot plant, and training facilities.



Focus

IFDC's work focuses on:

- Policy analyses and reform and institutional capacity building to develop competitive markets for agricultural inputs and outputs;
- Provision of tools and information for more efficient and environmentally sound management of plant nutrients;
- Information and recommendations to improve and sustain soil fertility and land productivity;
- Provision of technical assistance and knowledge to enhance the efficiency and safety of plant nutrient production and supply;
- Training for human resource development in all areas of work.

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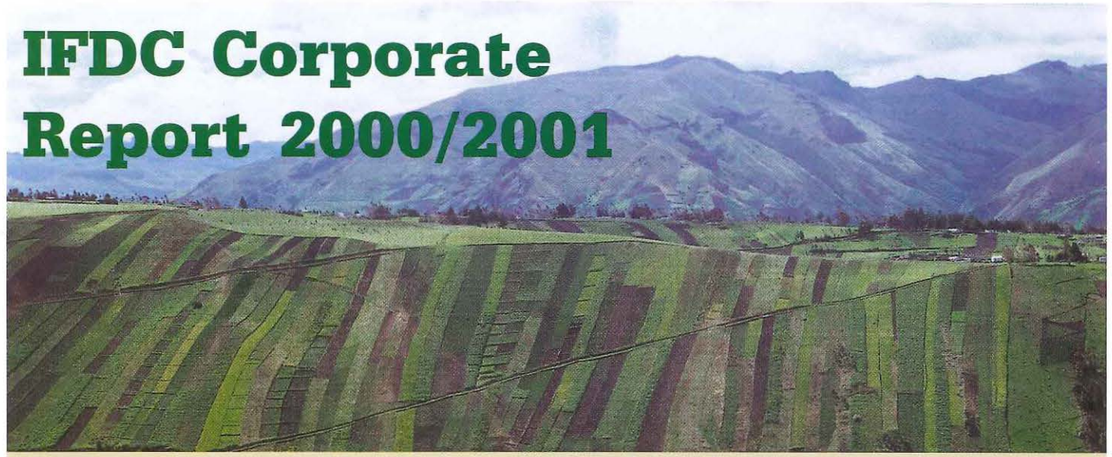


Acronyms

AAATA	Assistance to Albanian Agricultural Trade Associations
ACF	Agribusiness Credit Fund
ACFD	African Centre for Fertilizer Development
ADB	Asian Development Bank
AFADA	Albanian Fertilizer and Agricultural Inputs Dealers' Association
AFID	African Fertilizer Information Database
AFM	African Fertilizer Market
AIBDF	Agricultural Inputs Business Development Fund
AIMs	agricultural input markets
AIMSP	Agricultural Input Market Strengthening Project
AKA	Association of Kosovo Agribusiness
AN	ammonium nitrate
ANMAT	Adapting Nutrient Management Technologies
AOAC	Association of Official Analytical Chemists
ARC	Agricultural Research Council
ATDP	Agrobased Industries and Technology Development Project
BARC	Bangladesh Agricultural Research Council
BMZ	Bundesministerium für Wirtschaftliche Zusammenarbeit of the Federal Republic of Germany
CASP	Collaborative Agribusiness Support Program
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical
CIDA	Canadian International Development Agency
CIMMYT	International Maize and Wheat Improvement Center
CIP	International Potato Center
CNDC	Combating Nutrient Depletion Consortium
CONDESAN	Consortium for the Sustainable Development of the Andean Ecoregion
COSTBOX	Client-Oriented Systems Tool Box
CPPs	crop protection products
CYTED	Programa Iberoamericano de Ciencia y Tecnología para el Desarrollo
DAE	Department of Agricultural Extension
DfID	Department for International Development
DGIS	Netherlands Minister for Development Cooperation
DRAEP	Direction Régionale de l'Agriculture, de l'Elevage et de la Pêche
DREAM	Dynamic Research Evaluation for Management
DSS	decision support system
DSSAT	Decision Support System for Agrotechnology Transfer
EAR	European Agency for Reconstruction
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FGN	Federal Government of Nigeria
FIM	Financial Information Management
GEMCo	Greenhouse Emissions Management Consortium
GHG	greenhouse gases
GIS	geographic information system
GOM	Government of Malawi
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
HABA	Horticulture Albanian Business Association
IAEA	International Atomic Energy Agency
IAPAR	Agronomy Institute of Paraná
ICAT	Institut de Conseil et d'Appui Technique
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICSU	International Council for Science
IDCJ	International Development Center of Japan
IDSS	information and decision support system
IFA	International Fertilizer Industry Association
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IITA	International Institute for Tropical Agriculture
INIA	National Institute of Agricultural Research
INIAP	National Research Institute in Agriculture and Livestock
INM	integrated nutrient management
INRAB	National Institute of Agricultural Research of Benin
INTA	National Institute of Agricultural Technology
IPCC	International Panel on Climate Change
IRRI	International Rice Research Institute
ISFM	Integrated Soil Fertility Management
ISNAR	International Service for National Agricultural Research
ITRA	Institut Togolais de Recherche Agronomique
JICA	Japanese International Cooperation Agency
JIRCAS	Japan International Research Center for Agricultural Sciences
KADP	Kosovo Agribusiness Development Program
KASH	Albanian Agribusiness Council
KCl	potassium chloride
KEAP	Kosovo Emergency Agricultural-Input Program
KODAA	Kosovo Dealers and Agri-Inputs Association
KR2	Second Kennedy Round
MAI	Ministry of Agriculture and Irrigation
MARD	Ministry of Agriculture and Rural Development
MOS Andes	Management of Soils in the Andes
MOU	Memorandum of Understanding
NARES	national agricultural research and extension systems
NARS	national agricultural research systems
NASA	National Aeronautics and Space Administration
NGOs	nongovernmental organizations
OSWU	Consortium on Optimizing Soil Water Use
PAGE	Poverty Alleviation, Gender Equity and Environment
PK	phosphate/potash
PR	phosphate rock
PRONAMACHCS	Programa Nacional de Manejo de Cuencas Hidrográficas y Conservación de Suelos, Peru
QUEFTS	Quantitative Evaluation of the Fertility of Tropical Soils
SG2000	Sasakawa Global 2000
SM-CRSP	Soil Management Collaborative Research Support Program
SRFSA	Sustaining the Restructured Fertilizer Sub-Sector in Albania
SSA	sub-Saharan Africa
SSP	single superphosphate
SWNM	Soil, Water and Nutrient Management
TEPCO	Tokyo Electric Power Co.
TFI	The Fertilizer Institute
TOA	Tradeoff Analysis
TSBF	Tropical Soil Biology and Fertility Programme
UDP	urea deep placement
UNFCCC	United Nations Framework Convention on Climate Change
USAID	U.S. Agency for International Development
USDA	United States Department of Agriculture
USG	urea supergranule
WARDA	West African Rice Development Association

Letter From the Chairman of the Board

The challenges to agriculture in the 21st century, outlined by Dr. Robert W. Herdt, Vice President of the Rockefeller Foundation, in his essay in this publication, are real challenges to all international agricultural research organizations today. IFDC recognizes the broad implications for agriculture and nutrient management emanating from the sweeping changes that are impacting the earth and human beings in the 21st century.

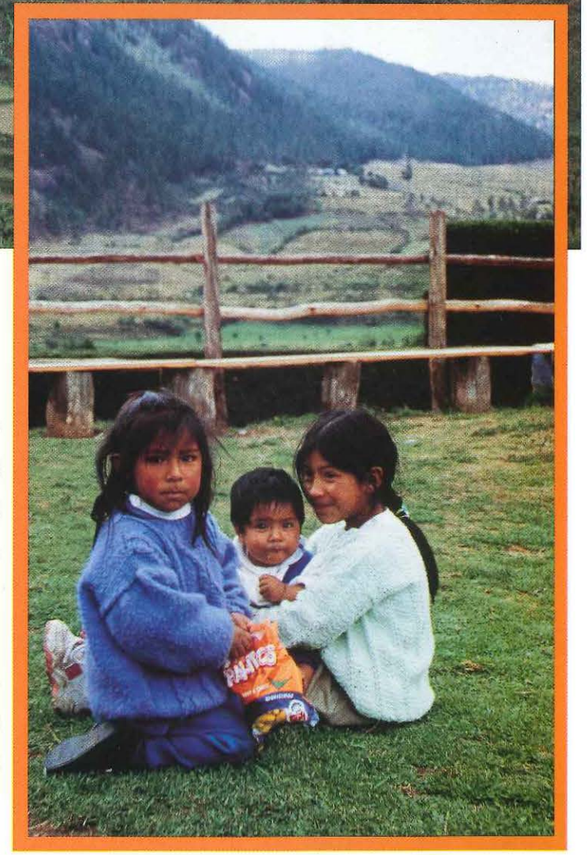
The ever-present challenge to IFDC and others involved in international agriculture is how to produce much more food on about the same amount of land with less water and less labor. We believe that to meet this challenge, recent trends in soil degradation and nutrient depletion must be reversed.

Scientists at IFDC and other international agricultural research centers will have to be visionaries in their approaches to meet the challenge and produce more "vignettes of innovative production systems in the developing world," of which Dr. Herdt speaks, if the world is to double its food production by 2040 or 2050, as required, according to population and nutrition experts. At the same time, these new production systems must preserve the natural resource base for future generations.

To meet the challenges of the 21st century, we must seize the moment and exhibit the necessary creativity, diligence, and determination to solve the food production problems of the new century and help reduce poverty around the world.

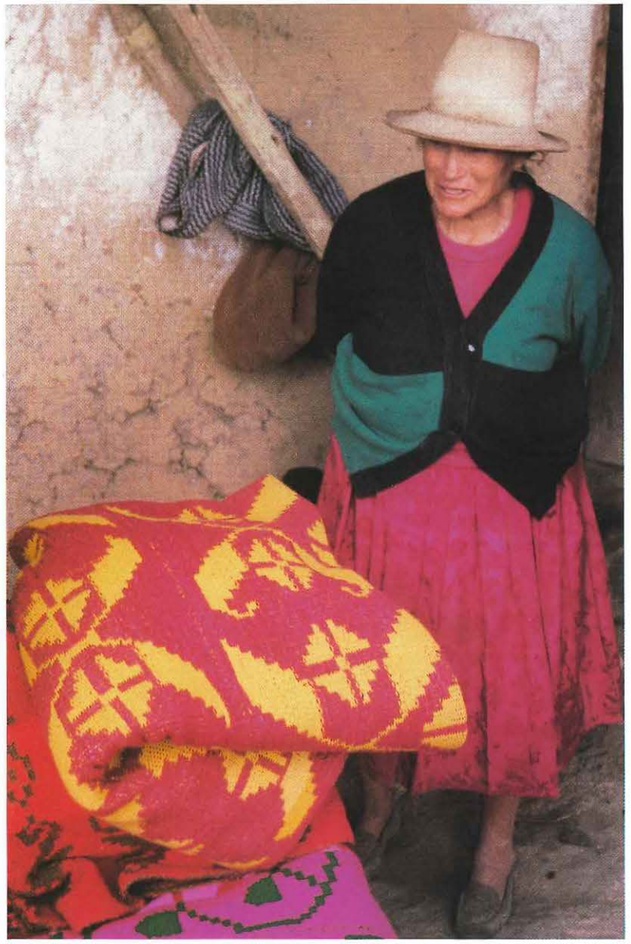
E. Travis York
Chairman
IFDC Board of Directors

Carta del Presidente de la Junta Directiva



Los retos de la agricultura del siglo 21, esbozados por el Dr. Robert W. Herdt, vicepresidente de la Fundación Rockefeller, en su escrito en esta publicación, son verdaderos retos para todas las organizaciones internacionales de investigación agrícola hoy en día. El IFDC reconoce las grandes implicaciones para la agricultura y el manejo de nutrientes que están emanando a partir de los grandes cambios que están impactando a la tierra y a los seres humanos del siglo 21.

El reto siempre presente al IFDC y a los demás interesados en la agricultura internacional es cómo producir muchos mas alimentos en aproximadamente la misma cantidad de terreno con menos agua y menos labor. Creemos que para afrontar este reto, se deben contrarrestar las recientes tendencias en la degradación de suelos y el agotamiento de nutrientes.

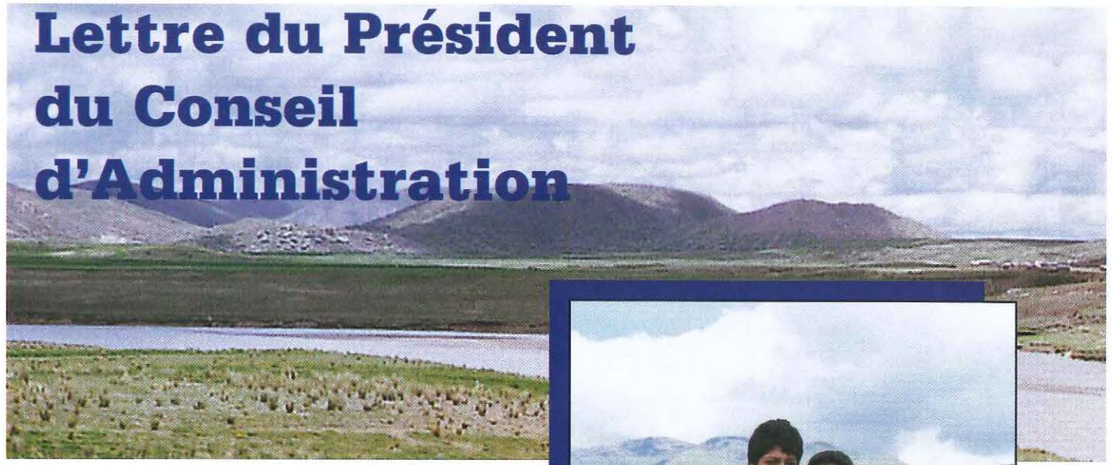


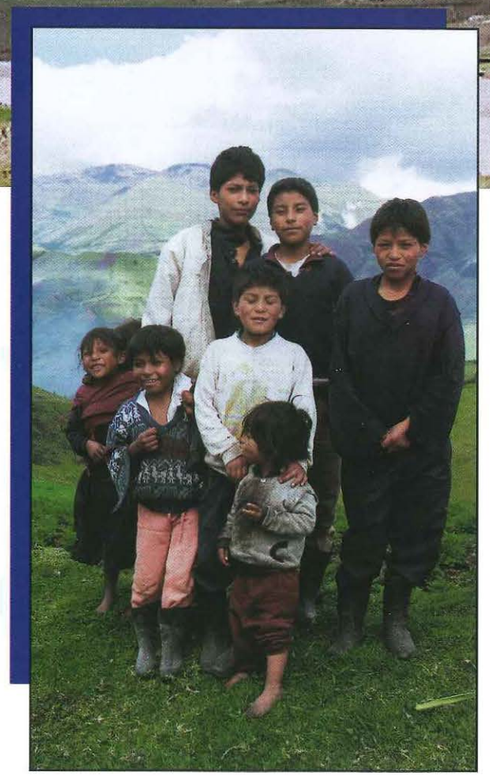
Los científicos del IFDC y otros centros internacionales de investigación agrícola tendrán que ser visionarios en su forma de afrontar el reto y producir mayores "ejemplos innovadores de sistemas de producción en el mundo en vías de desarrollo," del cual el Dr. Herdt habla, si el mundo ha de duplicar la producción de alimentos hacia los años 2040 ó 2050, como se requiere, según los expertos en población y alimentos. A la vez, estos nuevos sistemas de producción deben preservar la base de recursos naturales para las generaciones futuras.

Para afrontar los retos del siglo 21, debemos asir el momento y exhibir la creatividad, diligencia y determinación necesarias para resolver los problemas de producción de alimentos del nuevo siglo y ayudar a reducir la pobreza alrededor del mundo.

E. Travis York
Presidente
Junta Directiva del IFDC

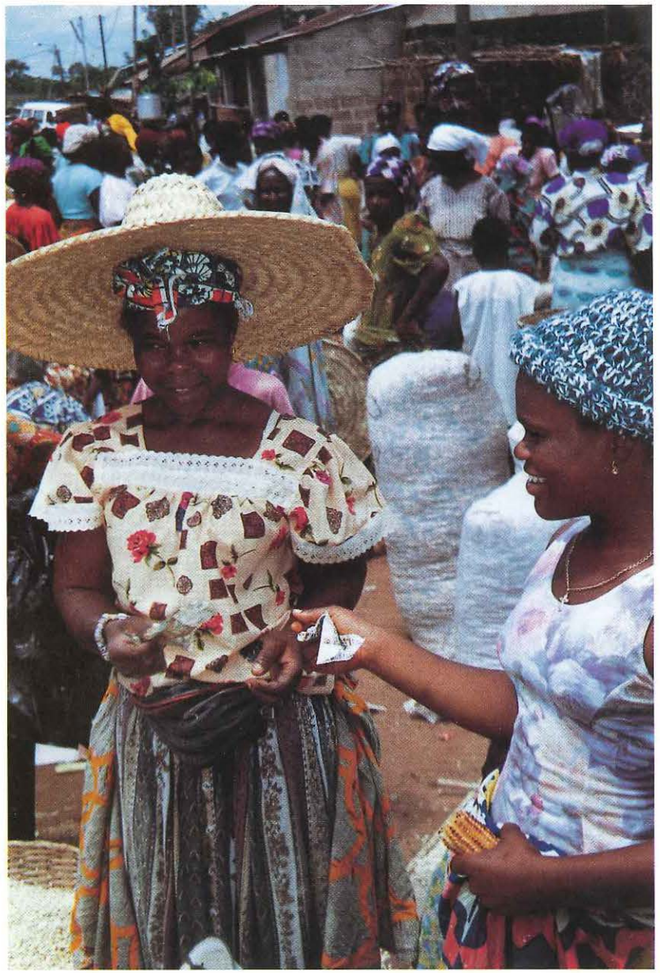
Lettre du Président du Conseil d'Administration





Les problèmes que pose l'agriculture en ce 21eme siècle, tels que soulignés par Dr Robert W. Herdt, Vice-président de la Fondation Rockefeller, dans son article ci-inclus, constituent aujourd'hui de véritables défis pour toutes les organisations internationales de recherche agricole. L'IFDC est conscient des implications des changements radicaux influençant la vie de la planète et celle des êtres humains en ce 21eme siècle, dans le domaine de l'agriculture et de la gestion des éléments nutritifs des plantes.

Le pressant défi pour l'IFDC et toutes les parties impliquées dans l'agriculture internationale est d'accroître la production alimentaire sur la même superficie cultivée et en utilisant moins d'eau et de main-d'œuvre. Nous avons la conviction que pour y parvenir, les tendances actuelles de dégradation des sols et d'épuisement des éléments nutritifs des plantes doivent être renversées.

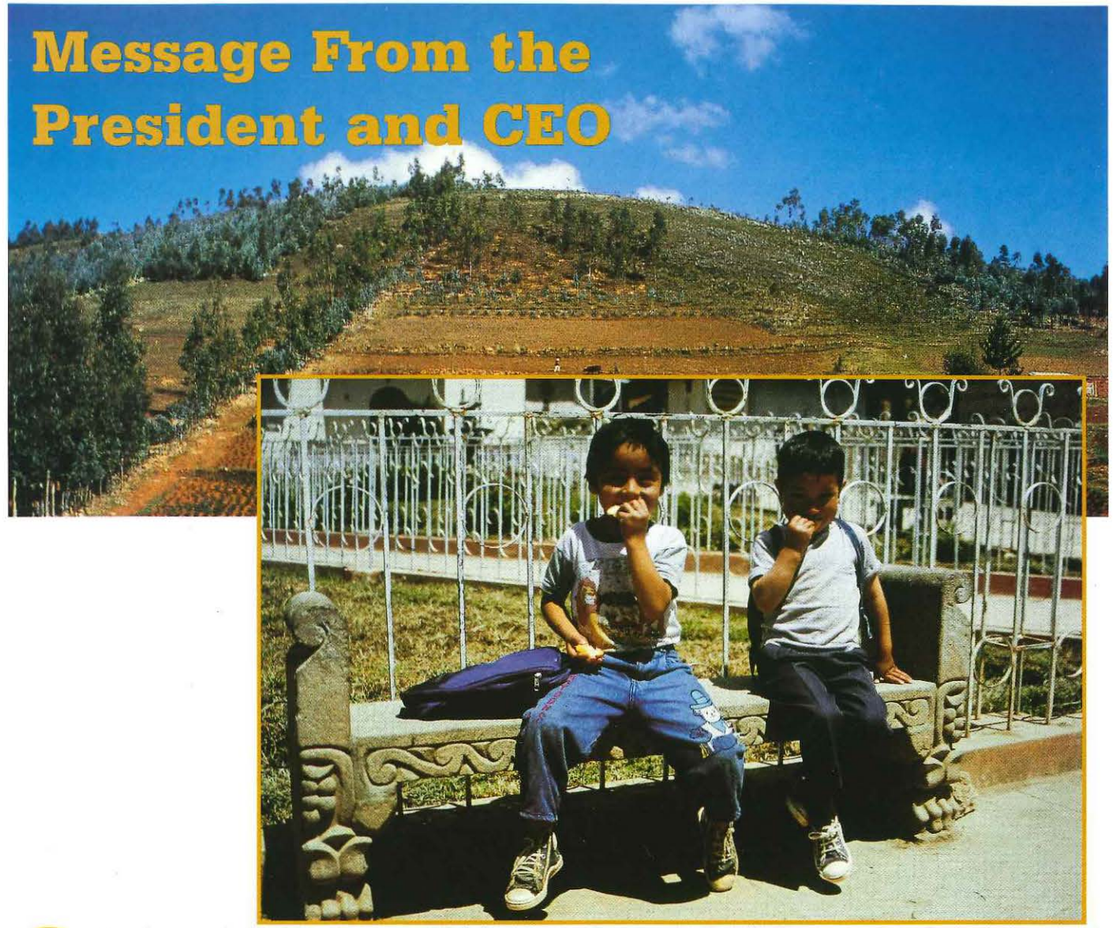


Si, comme le démontrent les experts en matière de population et de nutrition, le monde doit doubler sa production alimentaire à l'horizon 2040 ou 2050, les scientifiques de l'IFDC et des autres centres internationaux de recherche agricole doivent être des visionnaires dans leurs approches pour relever le défi et produire davantage des "vignettes de systèmes de production agricole innovateurs dans les pays en développement" dont parle Dr Herdt. Ces nouveaux systèmes de production doivent en même temps préserver la base des ressources naturelles pour les générations futures.

Pour relever les défis du 21eme siècle, nous devons saisir le moment et faire montre de dévouement, de créativité et de détermination dans les initiatives visant à résoudre les problèmes de production alimentaire et à réduire la pauvreté dans le monde.

E. Travis York
Président du
Conseil d'administration de
l'IFDC

Message From the President and CEO



At the dawn of the 21st century, IFDC is poised to meet the challenges of a dynamic agricultural development environment and the developing world's quest for food security. During 2000/2001 the Center has realized numerous achievements as we have traveled along the road to food security with our partners in the developing countries and the developing market economies.

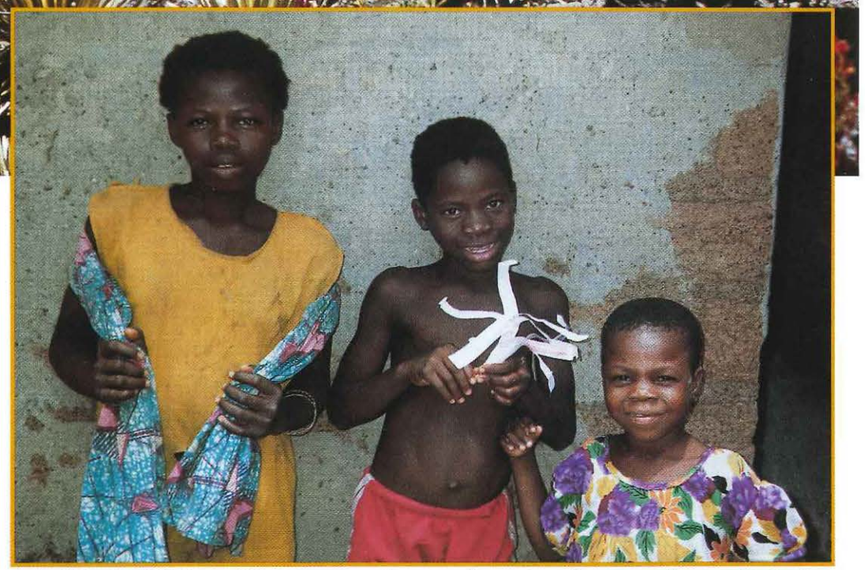
In Bangladesh, Vietnam, and Nepal our researchers and their counterparts are helping to reduce nitrogen losses from rice fields to produce more food in a manner that is more cost effective and more environmentally sound. Next, our journey has taken us to Kosovo to assist that province's private sector entrepreneurs to develop an agribusiness system that can serve as a catalyst to boost the province's food production levels. A new venture in Mozambique finds our researchers working with that country's farmers and businesses as they attempt to launch a market agriculture. Continuing the progress made in Albania, our marketing experts are assisting the new Albanian trade associations as they network with other organizations to enhance that country's agribusiness development. Moving next to farmers' fields in Togo, we witness advances being made by the Integrated Soil Fertility Management Project in 66 villages of 7 countries, with more than 1,400 farmers and 19 other organizations cooperating. Venturing next to Uruguay, we find an IFDC researcher studying ways

to help reduce the risks associated with environmental greenhouse effect by introducing agronomic practices that result in increased removal of carbon dioxide from the atmosphere, thus alleviating the problem of global warming. Traveling north to Ecuador and Peru, we find another IFDC scientist engaged in a collaborative project to employ a policy decision support system based on tradeoff analysis of agricultural production systems. This system will assist decision makers in assessing the sustainability of existing technologies, the potential for adoption of environmentally sustainable technologies, and the economic and environmental consequences of policy decisions for poverty, food security, and sustainability of the agro-environment. Accelerating the pace of the development of agricultural input supply systems in Malawi and Nigeria, IFDC has been assisting those countries in their pursuit of food security by promoting the development of well-functioning input markets so that their farmers can have easy and affordable access to agricultural inputs.

If we are to assist in the alleviation of poverty around the globe in the 21st century, we must enhance and enlarge our programs in the developing countries and developing market economies. We must pursue innovative avenues of agricultural and rural development that will best help to reduce poverty and promote food security. At the same time, we must promote policies that will not degrade the natural resources. The road is long and less traveled, but the potential for making a difference is great.

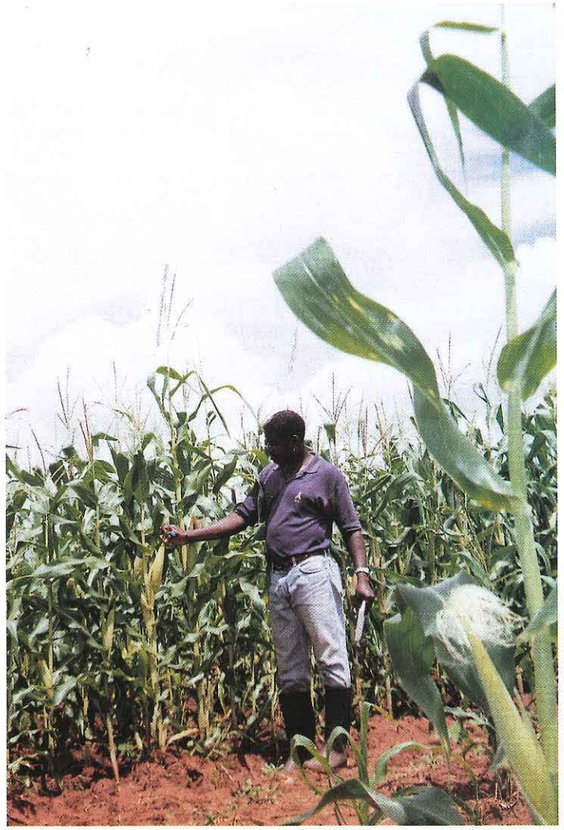
Amit H. Roy
IFDC President and
Chief Executive Officer

Mensaje del Presidente y Jefe Ejecutivo del IFDC



Al amanecer del siglo 21, el IFDC está listo para afrontar los retos de un ambiente dinámico en el desarrollo agrícola y en la búsqueda de la seguridad de alimentos en el mundo en vías de desarrollo. Durante 2000/2001 el Centro ha realizado numerosos logros a medida que hemos viajado el camino hacia la seguridad de alimentos con nuestros socios en los países en desarrollo y economías de mercados en desarrollo.

En Bangladesh, Vietnam y Nepal nuestros investigadores y sus contrapartes están ayudando a reducir las pérdidas de nitrógeno en los campos de arroz para producir mayor cantidad de alimentos en una forma con mayor efectividad de costos y más ambientalmente correcta. Recientemente, nuestro camino nos ha llevado a Kosovo para prestar asistencia a los empresarios del sector privado de esa provincia con el fín de desarrollar un sistema de agrinegocios que pueda servir de catalizador para impulsar los niveles de producción de alimentos en la provincia. Una nueva actividad en Mozambique encuentra a nuestros investigadores trabajando con los agricultores y negocios del país al tratar de lanzarse a una agricultura de mercado. Continuando el progreso hecho en Albania, nuestros expertos en mercadeo están asistiendo a las nuevas asociaciones de comercio a medida que éstas hacen enlace con otras organizaciones para aumentar el desarrollo de los agrinegocios del país. Seguimos luego a los campos de los agricultores en Togo, donde vemos los avances que se están logrando por el Proyecto Integrado de Manejo de Fertilidad de Suelos en 66 aldeas de 7 países, con más de 1,400 agricultores

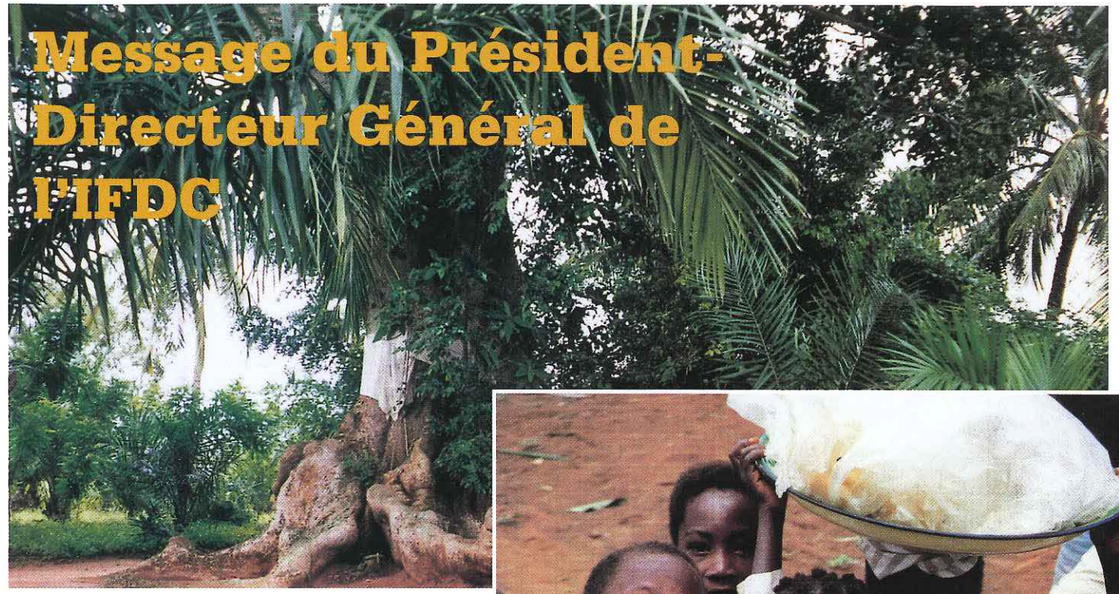


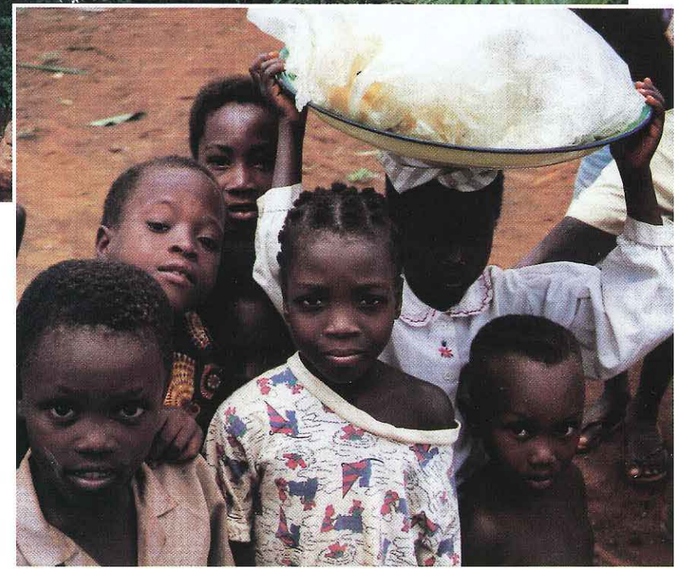
y 19 organizaciones que están cooperando. Viajando luego al Uruguay, encontramos a un investigador del IFDC estudiando maneras de ayudar a disminuir los riesgos asociados con los efectos de invernadero ambiental al implantar prácticas que resulten en un mayor retiro del dióxido de carbono de la atmósfera, asi aliviando el problema del recalentamiento global. Yendo al norte hacia el Ecuador y Perú encontramos a otro científico trabajando en un proyecto colaborativo para emplear un sistema de apoyo para la toma de decisiones basado sobre el análisis de intercambio de datos de los sistemas agrícolas de producción. Este sistema ayudará a las personas a cargo de las tomas de decisiones a evaluar la sustenabilidad de las tecnologías existentes, el potencial de adopción de tecnologías ambientalmente sustentables, y las consecuencias económicas y ambientales de las decisiones de políticas para la pobreza, seguridad de alimentos y sustentabilidad del agro-ambiente. Acelerando el ritmo del desarrollo de los sistemas de suministro de insumos agrícolas en Malawi y Nigeria, el IFDC ha estado prestando ayuda a estos países en su búsqueda de seguridad de alimentos al promover el desarrollo de mercados de insumos que funcionen adecuadamente con el fín de que sus agricultores tengan acceso fácil y económico a los insumos agrícolas.

Si vamos a prestar asistencia al alivio de la pobreza alrededor del globo en el siglo 21, debemos mejorar y aumentar nuestros programas en los países en desarrollo y sistemas económicos de mercados en desarrollo. Debemos seguir avenidas innovadoras de desarrollo agrícola y rural que optimicen la reducción de la pobreza y promuevan la seguridad de alimentos. Al mismo tiempo, debemos promover políticas que no degraden los recursos naturales. Este camino es largo y difícil, pero el potencial para las mejoras es grande.

Amit H. Roy
Presidente y Jefe
Ejecutivo del IFDC

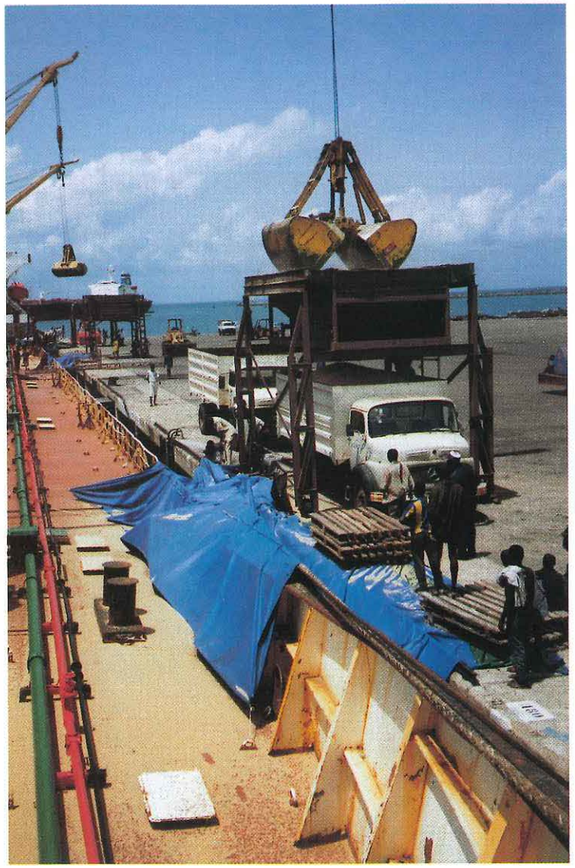
Message du Président-Directeur Général de l'IFDC





A l'aube du 21eme siècle, l'IFDC est prêt à relever les défis que pose la création d'un environnement de développement agricole dynamique pour assurer la sécurité alimentaire des pays en développement. En 2000/2001, le centre a engrangé de nombreuses réalisations en cheminant sur la voie de la sécurité alimentaire aux côtés de nos partenaires des pays en développement et économies de marché en émergence.

Au Bangladesh, au Vietnam et au Népal, nos chercheurs et leurs partenaires contribuent à réduire les pertes d'azote dans les rizières afin d'accroître la production rizicole de façon plus rentable et plus respectueuse de l'environnement. Notre parcours nous a conduit au Kosovo où nous aidons les entrepreneurs privés à mettre en place un système agro-industriel susceptible de relever les niveaux de la production alimentaire de ce pays. Dans le cadre d'une nouvelle initiative au Mozambique, nos chercheurs collaborent avec des paysans et des entrepreneurs locaux à l'instauration d'une agriculture de marché. Poursuivant les progrès réalisés en Albanie, nos experts aident de nouvelles associations professionnelles à se mettre en réseau avec d'autres organisations pour promouvoir le développement des agro-industries dans ce pays. Au Togo, c'est dans les champs paysans que s'inscrivent les progrès réalisés par le Projet de Gestion Intégrée de la Fertilité des Sols dans 66

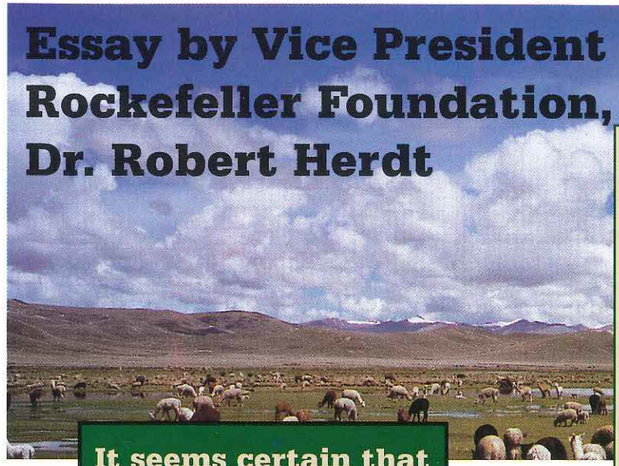


villages de 7 pays, avec la collaboration de plus de 1 400 paysans et 19 autres organisations. En Uruguay, un chercheur de l'IFDC étudie les moyens de limiter les risques liés à l'effet de serre par l'introduction de pratiques agronomiques qui permettent de réduire le dioxyde de carbone atmosphérique, atténuant ainsi le problème du réchauffement de la planète. En Equateur et au Pérou, un autre scientifique de l'IFDC collabore à un projet impliquant un système d'aide à la décision basé sur l'analyse des échanges dans les systèmes de production agricole. Ce système aidera les décideurs politiques à évaluer la durabilité des technologies disponibles, les possibilités d'adoption de telles technologies et l'impact économique et environnemental des décisions politiques concernant la pauvreté, la sécurité alimentaire et la durabilité de l'environnement agricole. Au Malawi et au Nigeria, l'IFDC aide à asseoir les bases d'une sécurité alimentaire durable par le développement de marchés d'intrants agricoles efficaces afin d'assurer leur disponibilité pour les paysans en temps utile et à des prix raisonnables.

Si nous voulons contribuer à réduire la pauvreté dans le monde au 21ème siècle, nous devons affiner et étendre nos programmes dans les pays en développement et économies de marché en émergence. Nous devons mettre en œuvre des stratégies de développement rural et agricole novatrices, susceptibles d'assurer la réduction de la pauvreté et la sécurité alimentaire pour tous. Ces efforts doivent être accompagnés de politiques de préservation des ressources naturelles. Le chemin à parcourir est long et inhabituel, mais la possibilité de faire la différence est énorme.

Amit H Roy,
Président-Directeur
général de l'IFDC

Essay by Vice President of Rockefeller Foundation, Dr. Robert Herdt

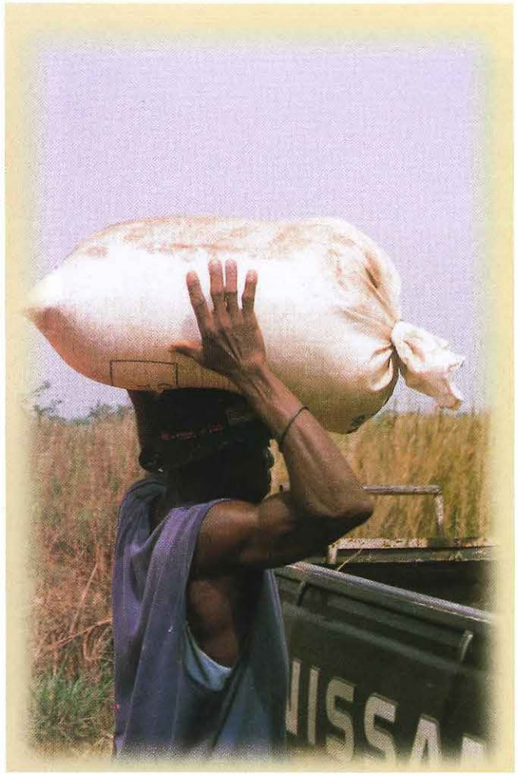


"Challenges for Agriculture in the 21st Century"— A synopsis of a keynote address presented during an IFDC-organized symposium at the annual meeting of the American Society of Agronomy in November 2000.

It seems certain that it will be necessary to produce a lot more food on about the same amount of land, with less water and with less labor.

The broad changes influencing the earth and the human species in the 21st century have innumerable interconnected implications for agriculture and nutrient management. Some interactions of socioeconomic changes with biophysical and technological changes seem clear from this vantage point, while others will surely catch us by surprise. It seems certain that it will be necessary to produce a lot more food on about the same amount of land, with less water and with less labor. It also seems certain that over the long run society will demand similar environmental standards from agriculture as it demands from other sectors. This means that externalities will increasingly be internalized or regulated in some way.

The challenge of producing more output with less land, water, and labor is not new. It has been the driving force for agricultural intensification for some decades, and it seems to have been met successfully, at least in the temperate regions. But there are worrying elements that begin to emerge when one closely examines trends in controlled long-term experiments. In the United States, "Development of higher yielding varieties which are more water efficient and disease resistant appears to be unable to overcome the decline in biological sustainability in the semiarid Pacific Northwest. In many situations, crop yields decline over time when inputs are held constant and increase only with application of increasing amounts of inputs. In Missouri, analysis of long-term trial data from the Sanborn Field indicated "continuous culture of wheat without the use of fungicides and insecticides was not sustainable even when adequate nutrition was supplied. These kinds of results suggest that even in temperate regions maintaining yield and long-run productivity requires continuous adjustment in cultivars and cropping practices. While the available evidence is not as rich, it seems more difficult to maintain productivity in the tropics and subtropics.



Stagnating yields in the wheat-rice system in the Punjab of India and Pakistan more than a decade ago led to an organized international effort to understand those changes. Declining yields on the International Rice Research Institute experiment station in plots where rice was continuously cultivated raised questions 20 years ago that are still unresolved. In fact, after a review of the evidence, two accomplished analysts conclude: "Particularly disturbing is the complete lack of long-term experiments on irrigated rice systems which document that it is even possible to produce sustainable increases in rice production over time."

These challenges seem associated with loss of soil quality and increased soil health problems. A recent comprehensive quantitative analysis for the Punjab of many factors that affect crop yields in farmers' fields indicates that the effects of controllable production factors like varieties, fertilizer, pesticides, and quantity of irrigation water are being offset by deterioration in the quality of soil, water and other biotic resources. A similar analysis for China has linked several indicators of soil stress to reduced productivity.

It is now clear that agricultural intensification can have negative local consequences, such as increased erosion, lowered soil fertility, and reduced biodiversity, negative regional consequences such as pollution of ground water and eutrophication of rivers and lakes; and negative global consequences, including impacts on atmospheric constituents and climate." The objective of much work in the sustainable agriculture area is to devise ecologically based management strategies that can increase the sustainability of agricultural production while reducing off-site consequences.

Achieving this objective is a huge challenge. Even simply devising appropriate definitions and indicators of sustainability or its absence is a challenge. Without getting into the range of views on sustainable agriculture, I will conclude with several vignettes of innovative production systems in the developing world. Each raises questions by appearing to give spectacular gains over the usual practices—each has been either ignored or ridiculed by the mainstream agricultural establishment. The challenge that I leave with you is to evaluate such systems in order to confirm or reject the incredible reports and, if confirmed, to explain them.

The objective of much work in the sustainable agriculture area is to devise ecologically based management strategies that can increase the sustainability of agricultural production while reducing off-site consequences.

The first system is the System of Rice Intensification developed by Tefsay Saina, a nongovernmental organization in Madagascar and "discovered" by Norman Uphoff, a political scientist at Cornell. In this system very young (e.g., eight-day-old) rice seedlings are transplanted rather than the more usual 21 to 30 day-old seedlings; seedlings are spaced at 25 cm apart which is wider than normal; one seedling per hill is transplanted compared with the usual practice of 5-9 seedlings per hill; the paddy fields are saturated but standing water is avoided. If it does not rain, water is added to a depth of one or two cm and fields allowed to dry for several days before water is added again. First, weeding is done 8 to 10 days after transplanting and 3 or more times thereafter with a rotary push hoe; composted manure is applied. The plants tiller profusely and produce yields in the range of 8 to 10 t/ha in areas where most farmers get less than 2 t/ha.

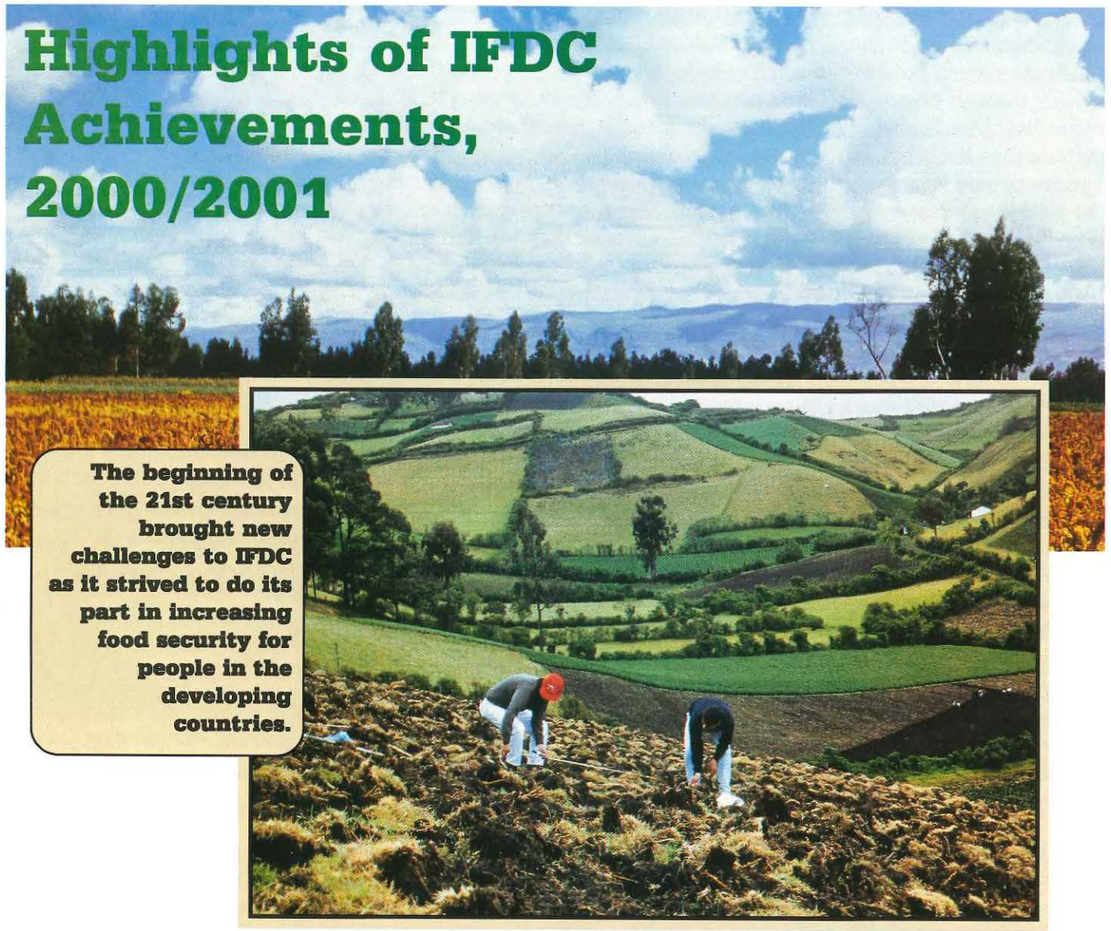
A second example of an unusual technique providing apparently high efficiency is the growing of maize in "pits" in Njombe District in the Southern Highlands of Tanzania. The dominant soils are red kaolinitic clays with moderate natural fertility and medium-to-high water holding capacity. Under conventional tillage they degrade quickly through compaction, and plant rooting is shallow. Apparently developed by a local farmer, the technique "involves digging pits 60-120 cm in diameter, 30-60 cm deep, and 75-100 cm apart. Crop residues and manure (one bucket of 20 liters) are put into each pit and mixed with topsoil, 20-25 maize seeds are then sown in each pit and later thinned to 15-18 plants depending on the size of the pit. He topdresses the pits with a mixture of manure slurry from the kraal floor and urine collected with his piped system." He harvested 20 bags per acre with the technique as compared to 5 bags/acre when planted the conventional way. A quick survey of farmers in several villages of Njombe District in June 1999 found that 71 farmers had already adopted or were adopting the innovation.

Over the next several decades, the world will require considerably more food than is produced today, on the order of a doubling by 2040 or 2050....It will take considerable new research to devise systems that can meet food needs while preserving the resource base for the long term beyond.

Deliberate mixing of species or genotypes in one crop field is a mark of traditional farming often thought to be a risk aversion strategy to combat yield variability. It may also promote greater output by reducing pests and pathogens. One recent report of a large-scale experiment to test the idea provides dramatic evidence. Farmers, researchers and extension personnel in five townships in Yunnan Province, China, cooperated to compare rice production in monocropped with mixed-variety stands. Hybrids normally are planted on over 95% of the fields, and yields commonly approach 10 t/ha. Foliar fungicide application is common. Glutinous or "sticky" rice varieties are highly valued for their use in specialty foods, but they are highly susceptible to the blast disease. One row of blast-susceptible sticky rice was planted between four rows of blast-resistant hybrid rice. In 1998 farmers followed the procedure on 812 ha, and in 1999 it spread to 3,342 ha. Land equivalent ratios, "indicate that an average of 1.18 ha of monoculture cropland would need to be planted to provide the same amount of hybrid and glutinous rice as were produced in 1 ha of mixture." By the end of the two-year program fungicidal sprays were no longer used.

Over the next several decades, the world will require considerably more food than is produced today, on the order of a doubling by 2040 or 2050. Much of this food will have to be produced by people in developing countries, either from intensification of present production systems or by bringing new land into production or by some combination. Expanding the area cultivated directly competes with land for wildlife and environmental uses, while intensification following "conventional" practices seems problematic based on experience to date. It will take considerable new research to devise systems that can meet food needs while preserving the resource base for the long term beyond.

Highlights of IFDC Achievements, 2000/2001



The beginning of the 21st century brought new challenges to IFDC as it strived to do its part in increasing food security for people in the developing countries.

Introduction

The beginning of the 21st century brought new challenges to IFDC as it strived to do its part in increasing food security for people in the developing countries. These challenges encouraged the Center to pursue more innovative technologies such as a decision support system (DSS) that links a geographic information system (GIS), a crop modeling system, and an economic model to assist decision makers as they implement agricultural policy, assign priorities, and allocate limited resources. Another example of an innovative technology that was developed is an information and decision support system (IDSS) that includes crop models, climate outlooks, remotely sensed information on weather and crop production, data on prices and costs, and land use. To assist the public and private sectors, donors, and nongovernmental organizations (NGOs) in sub-Saharan Africa, IFDC took the lead in developing a strategic framework to build an efficient and competitive agricultural input supply system. This valuable blueprint will significantly increase the supply of and improve smallholder farmer access to modern inputs through strengthened open and competitive markets and dealer networks. In the following highlights of IFDC activities during 2000/2001 in research and development, technology transfer, and human resource development, it is evident that the Center's work is (1) increasing smallholder access to improved agricultural inputs, (2) improving and expanding private sector agribusiness, (3) providing technical advice to developing-country partners, (4) taking international leadership roles in addressing African soil nutrient issues, (5) pursuing the development of new technologies, (6) developing ecologically sound agriculture, and (7) conducting innovative training programs to strengthen agricultural and economic development.

Increasing Small-Holder Access to Improved Agricultural Inputs

- **Agribusiness Successes of the Bangladesh Project**
  With funding from the U.S. Agency for International Development (USAID) and the Government of Bangladesh, the Agrobased Industries and Technology Development Project (ATDP) operated from January 1995 through July 2000. The project aimed to increase productive employment in agriculture and related enterprises by encouraging adoption of favorable policy enactment, market-driven technology development and transfer and by providing agro-enterprises with information and access to credit. In addition to fortifying the many successes resulting from the first four years of the project, FY 1999-2000 activities also yielded important accomplishments. For example, during 2000, ATDP assisted in promoting deep placement of urea supergranules (USG) to 700,000 farmers, creating 9,000 person years of employment and increasing paddy production by 400,000 mt valued at US $65.9 million during FY 1999-2000.

- **Village- and Regional-Level Integrated Soil Fertility Management Projects in West Africa**
  With financing from the International Fertilizer Industry Association's (IFA) "Farmers and Sustainable Agricultural Development" project, USAID's "Farmers for the Future" project, and Bundesministerium für Wirtschaftliche Zusammenarbeit of the Federal Republic of Germany's (BMZ's) Improving Integrated Nutrient Management Practices on Small Farms in Africa—a Combating Nutrient Depletion Consortium project (CNDC2), important progress has been made to extend Integrated Soil Fertility Management (ISFM) strategies on the village and regional levels in West Africa. In 2000/2001 the project covered 7 countries, 14 pilot sites, and 66 villages. New pilot sites were established in Burkina Faso, Mali, Ghana, and Nigeria. Strategic site selection, i.e., selecting zones and villages with relative advantages to adopt ISFM strategies, and consequent application of participatory—mutual learning—approaches during a three-phased project cycle (i.e., diagnosis, experimentation and pre-extension, extension and capitalization of institutional change) are key elements. Long-term dependency of farmers on "the project" is avoided. Institutional support concentrated on the organization and management of revolving funds by the farmers themselves, on the marketing of agricultural products, and on the distribution of inputs (involving both farmers and local-level input dealers). Pre-extension strategies like farmer-to-farmer visits and "open days" have promoted interest in ISFM strategies in the pilot zones. As a consequence, demand for fertilizers, improved seeds, and other agricultural inputs is rising rapidly in the pilot villages. However, for large-scale extension of the project within the pilot zones, more funds will be needed to enable farmers to increase fertilizer use efficiencies, to train extension agents, and to strengthen professional capacities of farmers' organizations and input dealers' networks during a short transitional period. Inconsistent government policies also often hinder increased and effective implementation of the private sector. Despite these observations, the project is developing an adequate and efficient approach to stimulate agricultural intensification in well-targeted zones of West Africa.

  The project addresses the constraint of soil nutrient depletion in East, Central, and West Africa through a coordinated approach involving existing consortia and networks associated with the CNDC of the Consultative Group on International Agricultural Research (CGIAR) system-wide program on Soil, Water and Nutrient Management (SWNM). The objective of the project is to increase the capacity of small-scale farmers in Africa to develop, adapt and use integrated nutrient management (INM) strategies. CNDC2 is implemented via the SWNM program, co-convened by Centro Internacional de Agricultura Tropical (CIAT) and CNDC, co-convened by the Tropical Soil Biology and Fertility programme (TSBF) and IFDC. CIAT, TSBF, and IFDC are the main international agricultural research centers involved. In West Africa the CNDC2 project focuses on the central zones in Togo and Benin, both cotton-growing areas. The CNDC2 project started its activities in July 1999, with a country meeting in Sokodé, Togo, as foreseen in the project document, based on a workshop in Kampala. Partner institutions involved in Togo are the Institut de Conseil et d'Appui Technique (ICAT), the Institut Togolais de Recherche Agronomique (ITRA), and the Direction Régionale de l'Agriculture, de l'Elevage et de la Pêche (DRAEP). The National Institute of Agricultural Research of Benin (INRAB) coordinates the activities in Benin.

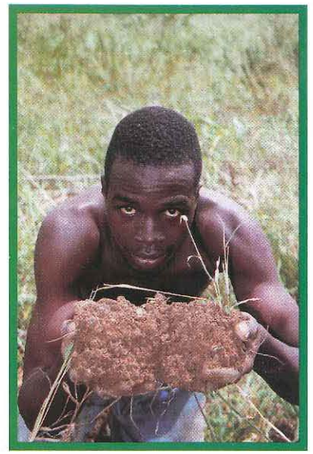
- **The Albanian Fertilizer and Agricultural Inputs Dealers' Association (AFADA) and Other Trade Association Activities**
  In Albania work has continued in developing private sector extension services through the trade associations utilizing the Technology Transfer Centers set up originally by AFADA. Field days and demonstrations have been held on new potato varieties, farm machinery and potato harvesting equipment. Training has continued in extension methodology for the private sector to ensure that new ideas and technology are communicated to farmer customers.

- **Sustaining the Restructured Fertilizer Sub-Sector in Albania (SRFSA)**
  At the end of 1999 IFDC successfully completed a 4-year project to sustain the restructured fertilizer sub-sector in Albania. This project built on a previous IFDC project that established an effective private fertilizer market in the Balkan country.With a total funding of about US $8.6 million, the project met or surpassed the goals established for the SRFSA project. As a result of the project, fertilizer imports rose from 32,000 tonnes in 1995 to 75,000 tonnes in 1998 and 1999. Private enterprises now supply 100% of fertilizers, 95% of crop protection chemicals, and 80% of seeds. Seventy-four percent of dealer imports are self-financed. Now fertilizers are used by 80% of farmers in Albania.

- **Kosovo Emergency Agricultural-Input Program**
  In view of IFDC's success in establishing a private-sector agricultural-input network in neighboring Albania, USAID provided the Center with a US $750,000 emergency grant to assess the emergency requirements for agricultural inputs for the next cropping season and the technical assistance needed to support the organization of a private-sector distribution network in Kosovo. During its 8-month duration, the Kosovo Emergency Agricultural-Input Program (KEAP) was able to identify 150 input dealers and 18 importers that would serve as a backbone to the agricultural-input distribution system and helped them form a trade association. The project also disseminated assessments of input requirements; assessed damages and provided advice to flour and feed millers, vegetable processors, and seed producers; established associations of flour millers and feed and poultry producers; provided policy recommendations on trade, taxation, and regulations; and helped establish contacts with regional suppliers resulting in importation of 4,000 tonnes of fertilizer and 800 tonnes of seed potatoes. The results of KEAP encouraged USAID to fund a 2-year project, currently under execution, to strengthen the agribusiness sector.

- **Fertilizer Assistance in Kosovo**
  With funding from the European Agency for Reconstruction (EAR), IFDC brought into Kosovo 20,000 tons of fertilizers and introduced them to the private sector in a market-friendly manner, which strengthened the input supply sector. There were 111 successful purchasers of 360 lots, raising almost 6.3 million DM. This has increased the commercial availability of fertilizer in the province and supplied funds for an agribusiness credit fund.

- **Mozambique Project**
  In Mozambique IFDC is undertaking a 2-year development effort, referred to as the Agricultural Input Market Strengthening Project. This project is geared toward improving access to agricultural inputs in that country through a market-driven approach. The project is seeking to improve agricultural input market conditions—a prerequisite to enhanced and expanded trade and investment in the agricultural inputs market. The two main goals of the project are:
  - To create a policy environment that is conducive to private-sector investment in agricultural inputs markets, including assisting the Ministry of Agriculture and Rural Development (MARD) in reforming the Second Kennedy Round commodity grants program of the Government of Japan to make it compatible with commercially sustainable procedures and
  - To assess the requirements to establish an agricultural inputs regulatory system in Mozambique and prepare a draft law and regulations for controlling the quality of agricultural inputs during import and distribution.



Improving and Expanding Private-Sector Agribusiness

- **ATDP Achievements in Agribusiness**
  The ATDP played a leading role in transforming attitudes toward agribusiness in Bangladesh. The project demonstrated the opportunities for commercial agriculture and encouraged a first generation of agro-entrepreneurs to explore new paths and opportunities. The project in many cases exceeded its primary contractual targets as follows:
  (1) Against a target of 100,000 over the five years, 700,000 farmers adopted more productive, environmentally sound technology (mainly through the use of USG fertilizer).
  (2) Compared with a target of 80, contract grower arrangements numbered 172.
  (3) Investments and loans made in agribusiness totaled 12,700, nearly double the target of 7,000.
  (4) Representing 2.5 times the goal, $257 million in credit and investment was realized.
  (5) Versus a target of 130,000, new jobs in agribusiness were created for 70,000 people.
  (6) Over 50 significant policy reforms were enacted.

- **Assistance to Albanian Agricultural Trade Associations (AAATA) Project**
  In the AAATA project in Albania, IFDC initiated a contract between the subcontractor, the Collaborative Agribusiness Support Program (CASP), led by Mississippi State University, and Agridev, an Israeli agribusiness consulting company, which has access to a wide range of consulting skills in agribusiness and developing-country experience. As a result a full-time Israeli agribusiness technologist is working in Albania, and IFDC has signed a Memorandum of Understanding (MOU) with Agridev to cooperate on agribusiness projects globally. The experience to date has been very positive.

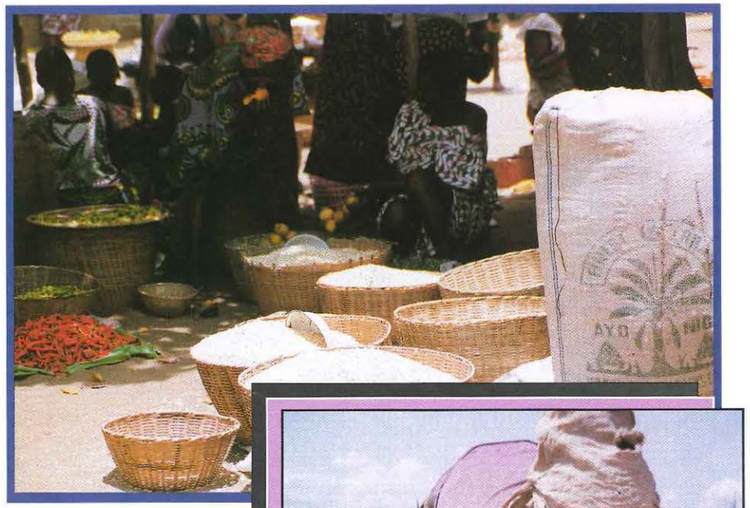
- **Kosovo Project**
  In June 2000 IFDC began a two-year agribusiness development project that covers trade association development, policy reform, private sector extension services, agribusiness technical assistance, and credit facilita-

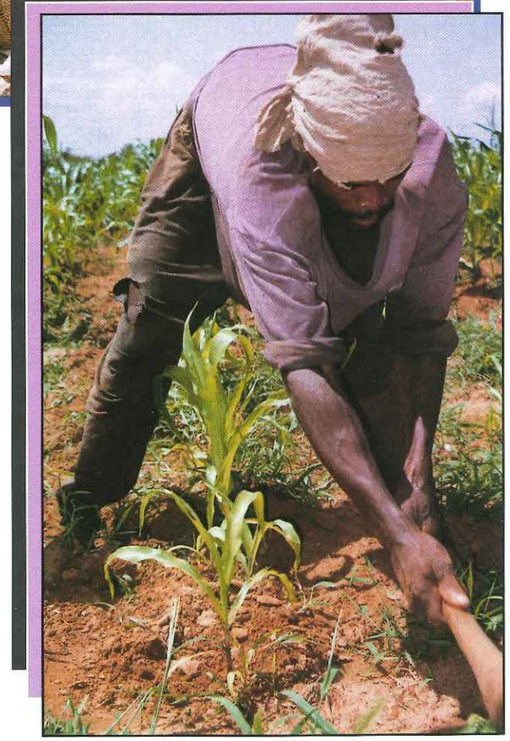
tion. A pilot credit scheme was initiated for input dealers, poultry producers, and feed mills with a Dutch NGO. IFDC has established and is developing three trade associations (inputs, poultry, milling) and an agribusiness advocacy association, the Association of Kosovo Agribusiness (AKA). This has achieved beneficial policy reforms in import duties and taxation. IFDC submitted proposals to the United States Department of Agriculture (USDA) for the monetization of imported feed grains and protein meal to create agribusiness revolving credit funds in both Albania and Kosovo.

Providing Technical Advice to Developing-Country Partners

- **Completed Tanzania Report**
  Under the IFDC/Sasakawa Global 2000 (SG 2000) collaborative arrangement, a study was completed on "Revitalizing the Fertilizer Market in Tanzania: Challenges and Opportunities." The study identified various constraints affecting the performance of the fertilizer market in Tanzania and suggested policy measures related to capacity building and a favorable policy environment for strengthening the functioning of the fertilizer market.

- **Completed a Strategic Framework for Agri-Input Supply for Sub-Saharan Africa (SSA)**
  The goal is to guide interested stakeholders, including donors and national governments, in promoting sustainable agricultural input supply systems in SSA by providing a generic road map to strategically strengthen the private sector and allow the public sector, donors and NGOs to more actively fulfill their necessary functions. The framework, published in French and English, was ratified in a workshop held in Addis Ababa, Ethiopia, involving continent-wide stakeholders from the private and public sectors, donors, and NGOs. One of the recommendations of the workshop was to validate this framework in specific countries.





- **Completed Malawi Action Plan Report**
  Malawi was the first country where the generic framework was used to develop a specific country action plan. The goal of this study was to significantly increase the supply of and improve smallholder farmer access to modern inputs through strengthening open and competitive markets and dealer networks. The plan provides an assessment of the agri-inputs markets and constraints to improved efficiency and offers recommendations for their removal. It was widely accepted by stakeholders in Malawi, including the Government of Malawi (GOM) and donors. Remarkably, the European Union (EU), World Bank, USAID, and the Department for International Development (DfID), United Kingdom, jointly funded this work. The Action Plan document was used by the Ministry of Agriculture and Irrigation (MAI) to develop a broader project proposal on input and output market development. The proposal is being considered by various donors for possible funding.

- **Completed Input Sector Needs Assessment for Nigeria**
  With partial funding support from SG 2000 and in collaboration with the International Institute for Tropical Agriculture (IITA) and the West African Rice Development Association (WARDA), IFDC took the lead in conducting an assessment of the agricultural input markets in Nigeria. The Federal Government of Nigeria and USAID also participated in the assessment work. Policy instability, lack of human capital and poor implementation of the regulatory frameworks lead to inadequate and untimely supply of inputs—improved seed, fertilizers, and crop protection products—for the farmers. A national stakeholder's workshop developed consensus about measures to be implemented to improve the functioning of the input markets.

- **Fertilizer Control Order for Cameroon, Ghana, and Mozambique**
  With funding from diverse sources, including various donors and even direct national funding, IFDC is assisting countries such as Cameroon, Ghana, and Mozambique in setting up consumer regulatory systems for fertilizers. Regulatory systems are necessary to protect the consumers and the dealers of agricultural inputs. In Mozambique, IFDC specialists are developing regulatory systems for fertilizers and crop protection products. An initial assessment has been performed to determine the activities that are required to establish such a system in each case. This assessment will be followed by the preparation of manuals, laboratory designs, equipment lists, inspection procedures, and in some cases even drafting the regulatory law and regulations.

Taking International Leadership Roles in Addressing African Soil Nutrient Issues

- **Sustainable Agricultural Production and Market Development**

The goal of the project, Sustainable Agricultural Production and Market Development, is the promotion of sustainable agricultural production and market development through the provision of market information and through technical assistance to governments of Burkina Faso and other countries to develop national strategies and action plans for soil fertility management. This project was completed in June 2000. During 2000 the project accomplished the following:

(1) Relevant soil fertility information, including fertilizer market intelligence was provided to various stakeholders through the publication of the monthly African Fertilizer Market (AFM) bulletin and its special issue (in English and French). The main theme addressed in the last special issue was on the use of phosphate rock for soil fertility improvement in African agriculture.

(2) The World Bank and the Food and Agriculture Organization of the United Nations (FAO) investment center collaborated with IFDC to undertake joint missions to review and analyze the input distribution systems in Mali, Ghana, and Guinea to provide baseline documents and recommendations on which to base the country's agricultural intensification in the national action plans.

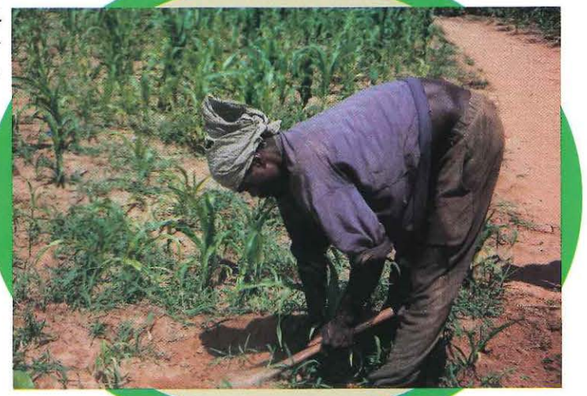
(3) The African Fertilizer Information Database (AFID) has been restructured and expanded with assistance from international software engineers. It aims at analyzing the profitability of fertilizer use and various issues related to soil fertility, taking into account different crops and agroecological and socioeconomic conditions.

- **Favorable Socioeconomic and Policy Environments for Soil Fertility Improvement**

The goal of the project, Favorable Socioeconomic and Policy Environments for Soil Fertility Improvement, is the promotion of the development of favorable socioeconomic and policy environments necessary for soil fertility improvement. This is a new 4-year project with Netherlands Minister for Development Cooperation (DGIS) funding that was started in July 2000. During 2000/2001 the project's primary accomplishments are activities for the implementation of the project and include the following:

(1) Exploratory studies of farmer-based organizations in the project focus countries: Burkina Faso, Ghana and Mali. The studies emphasize how farmers are organized and how they participate in national decision-making concerning soil fertility improvement. Working documents on each study were prepared resulting in a synthesis document and a draft paper for submission to a journal based on the findings.

(2) Preliminary missions in the focus countries to inform and explain project objectives to key stakeholders, including decision makers and the private sector.



- **Integrated Soil Fertility Management Projects**

Both the "Farmers for the Future" and the "Farmers and Sustainable Agricultural Development" projects are developing ISFM technologies at the farm level in several pilot zones in West Africa. Production systems and socioeconomic and agroclimatic conditions differ widely between the zones; however, they all are supposed to have relative advantages for ISFM adoption. Considerable attention is given to integrate farmers' initiatives and knowledge to adapt ISFM strategies to their conditions. The emphasis on the complementary use of organic and mineral fertilizers is quite new, both for farmers and for many nongovernmental and governmental organizations in West Africa. Farmers in the pilot sites, however, are discovering the cumulative effects of continuous applications of organic and mineral fertilizers despite their initial caution. The mutual learning approach based on flexible participatory approaches instead of the top-down transfer of technology has been a crucial element. Farmers have been assisted to visualize nutrient flows, to plan ISFM experiments, and to analyze the results. Critical awareness and enhanced innovative capacities are essential to foster sustainable agricultural intensification in the pilot regions. The integrated approach, covering both technical and institutional changes, attracts attention from both national and international development-oriented institutions.

- **Collaborative Research Programme for Soil Fertility Restoration and Management in Resource-Poor Areas of Sub-Saharan Africa**

With funding from the International Fund for Agricultural Development (IFAD), the Collaborative Research Programme for Soil Fertility Restoration and Management in Resource-Poor Areas of sub-Saharan Africa was conducted during June 1996–July 2000. This programme was completed in cooperation with the TSBF programme in Nairobi, Kenya, and the African Centre for Fertilizer Development (ACFD) in Harare, Zimbabwe, with IFDC serving as leading partner. The aim of the project was to develop technological packages that are sustainable and economically attractive for farmers. In West Africa the crop production packages aimed at increasing the efficiency of the essential but relatively expensive mineral fertilizers. Increasing the efficiency can be achieved by soil fertility improvement. In southern Togo the central theme was improving the soil organic matter status of the soils by introducing a cover crop (mucuna); whereas, in northern Togo, Niger and Ghana, IFDC scientists studied the use of compost. In southern Africa scientists conducted experiments in Zimbabwe, Malawi and Zambia. Because manure is amply available, the TSBF scientists investigated the effect of different storage methods for maintaining or improving the quality of the manure to be used. In both regions they studied the socioeconomic aspects.

- **Collaboration With the International Maize and Wheat Improvement Center (CIMMYT)**

  * **East Africa Cereals Program**

IFDC worked with CIMMYT in Eastern and Central Africa to conduct a long-term project, funded by the Canadian International Development Agency (CIDA). The project's objectives included improved coordination and regional collaboration in agronomic research through the East and Central Africa Maize and Wheat network, improved capacity of national agricultural research systems (NARS) scientists to carry out agronomic research, and improved systems for sustainable maize and wheat production and natural resource conservation. An IFDC scientist in Nairobi managed a portfolio of 42 small grants projects for NARS scientists addressing problems related to soil fertility management, soil and water conservation, weed and pest control, and technology dissemination. More than 50% of these projects concern the development, evaluation, and dissemination of integrated nutrient management practices and are most often carried out on farmers' fields at multiple locations with farmer participation.

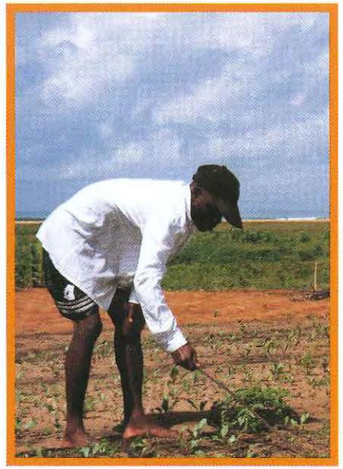
  * **Striga Research Projects**

The parasitic weed, *Striga hermonthica*, can cause maize yield losses of 50%-100% and infests over 60M ha of land in sub-Saharan Africa. Its presence is usually associated with low soil fertility and monocropping with cereals. Research coordinated by an IFDC scientist in Kenya focuses on agronomic systems designed to improve soil fertility and diversify crop production by introducing legumes in improved fallows, rotations, and intercrops. These technologies are being introduced to farmers using participatory research and evaluation methods in the *striga*-infested areas of western Kenya.

* **Management of Moisture Stress**
An IFDC scientist collaborated with the CIMMYT Africa Maize Stress Project to develop and implement on-station and on-farm testing of soil moisture conservation methods to enhance the potential of drought-tolerant maize varieties developed by the project. Tied ridges were shown to be effective in increasing maize growth under moisture stress conditions.

* **Crop Modeling**
An IFDC scientist in East Africa is participating in a project supported by the Ecoregional Fund and coordinated by the Agricultural Research Council (ARC) Summer Grain Centre in South Africa. He is assisting NARS scientists in Ethiopia, Kenya, Tanzania and Uganda to carry out trials to develop genetic coefficients for local maize varieties for the CERES-maize crop simulation model. These have been combined in a database of genetic coefficients for maize varieties being developed at the ARC for eastern and southern Africa.

- **Consortium to Combat Nutrient Depletion**
The CNDC is using decision support tools to identify limiting factors, yield potentials, and management strategies to improve soil fertility in sub-Saharan Africa. The coarse texture, low organic matter content, low available soil P, and very low cation exchange capacity of West African soils combined with erratic, albeit high intensity rainfall results in low nutrient use recovery independent of whether the nutrient is applied as mineral fertilizers or from organic sources. Given the high potential for losses of N and even P and high input costs, the use of relevant DSSs to help improve nutrient use efficiency, soil fertility, and crop yields is urgently needed. DSSs offer the farmers in the region the options to choose local resources for increasing crop yields and/or improving soil fertility. The Decision Support System for Agrotechnology Transfer (DSSAT) linked with the Organic Resource Database of TSBF is now used to predict not only N supply but also the release pattern and its synchrony with plant N demand. As expected, this would improve nutrient use efficiency and reduce losses of nutrients, particularly N from organic sources. The ongoing field research, field- and computer-based training programs, workshop participation, and progress meetings are all contributing towards the transfer of nutrient management strategies and systems methodologies to national agricultural research and extension systems (NARES)—one of the goals of the project.



- **ICRISAT Collaboration**
An IFDC senior soil fertility scientist, stationed at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Sahelian Center, in Niamey, Niger, conducted research that focused on helping to solve the food production problems in sub-Saharan Africa. During 2000 this work represented a synthesis of the research conducted at the Center. The synthesis concentrated on the intensification of millet production in the Sahel, identifying practical options. At the end of 2000 the scientist will leave IFDC after 18 years of enthusiastic work.

- **Integrated Soil Water and Nutrient Management Transect Study**
IFDC is taking a leading role in implementing a transect study in SSA to comparatively evaluate water and nutrient constraints to crop production and recommend improved resource management and crop production through closer matching of management options to agroecological and socioeconomic constraints [within the log frame of the SWNM Program]. It is an interconsortia undertaking by the CNDC and the Consortium on Optimizing Soil Water Use (OSWU). The activity combines the serious problem of soil nutrient depletion with water availability in West Africa. It provides a framework for cooperative research between CNDC and OSWU partners and lends added value to the nutrient and water research undertaken by the SWNM Program.

Pursuing the Development of New Technologies

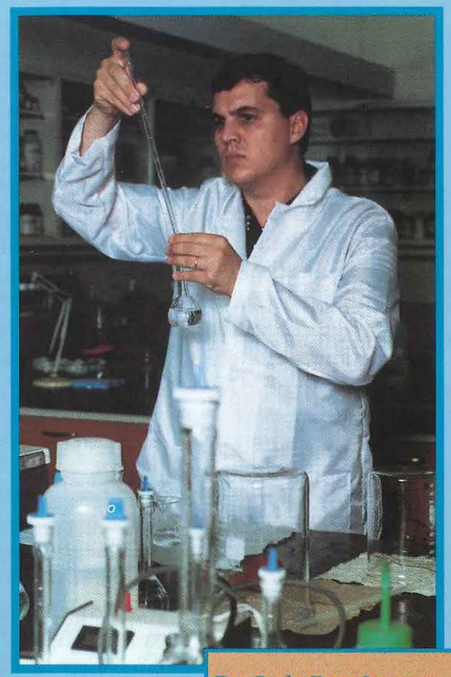
- **Canola Project Update**
IFDC scientists previously showed that medium-to-high reactive apatitic phosphate rocks could be 60%-80% as effective as water-soluble phosphorus fertilizers for canola grown in neutral and alkaline soils. However, the agronomic effectivness of phosphate rocks tended to decrease as calcium carbonate content in alkaline soils increased. For these types of soil, mixing with water-soluble phosphorus was shown to be an effective means to increase their agronomic value for canola. Also, two iron-rich nonapatitic phosphate rocks (calcined Christmas Island C-grade and Phospal from Senegal) were shown to be more agronomically effective than apatitic phosphate rocks.

- **Thrasher Foundation Project Update—Iron Fortification**
IFDC scientists have conducted several experiments on the use of iron-rich phosphate fertilizers to increase iron density of cereal grains for human nutritional needs. Crops of barley, flooded rice, upland rice, and soybeans have been grown to maturity. USDA provided seeds of barley and flooded rice varieties with a low phytic acid trait, and the International Rice Research Institute (IRRI) supplied seeds of a flooded rice variety with high iron absorption capacity. The results showed that the iron density of barley grain was increased by 32%-38% whereas phytic acid was decreased by 40%-50% when a calcined iron-rich phosphate rock was applied to an alkaline soil. However, the iron density was increased up to 15% only with other crops. The Thrasher Research Fund supports this project.

- **FAO/International Atomic Energy Agency (IAEA) Collaboration Update**
IFDC researchers have collaborated with FAO/IAEA in a new research project entitled "Management and Conservation of Tropical Acid Soils for Sustainable Crop Production." IFDC scientists have conducted long-term greenhouse experiments over three years on the use of nonconventional phosphate fertilizers (Sechura phosphate rock from Peru and partially acidulated Huila phosphate rock from Colombia) as influenced by liming in mono-crop with upland rice or soybean-upland rice-soybean cropping systems. They also measured biological nitrogen fixation by using an N-15 isotopic method. The first year's results show a strong interaction among phosphorus source, liming, and cropping system, especially in the residual effect.

- **Brazilian Phosphate Rock Project**

In Brazil phosphate rocks that have high contents of iron and aluminum impurities are used in the production of acidulated phosphate fertilizers. Fertilizer manufacturers have used expensive industrial processes to reduce the concentration of impurities so that the acidulated phosphate products can meet the current Brazilian regulations, which specify minimum contents of total available as water-soluble phosphorus. Since the agronomic effectiveness of phosphate fertilizer is influenced by soil properties and crop species, it is possible that the requirement of water-soluble phosphorus could be lower for certain soils and crops. A visiting scientist from Brazil's University of São Paulo has conducted research at IFDC to address this problem. Results show that for certain agronomic conditions it is possible to use phosphate fertilizers with lower water solubility than that specified by Brazilian legislation. For example, in a recent greenhouse experiment, a single superphosphate with only 46% of total available phosphorus as water-soluble phosphorus was deemed 88% as effective as 100% water-soluble phosphorus in increasing the dry-matter yield of upland rice and as effective as 100% water-soluble phosphorus in increasing the dry-matter yield of flooded rice. It is hoped that this research will translate into a saving for Brazil's fertilizer industry and farmers.



Dr. Luis Prochnow, Visiting Scientist from Brazil, investigates the use of his country's phosphate rock to increase food production.

- **Gafsa Phosphate Rock Trials in China**

Gafsa phosphate rock from Tunisia has been evaluated in the acid soils of southeast China since 1997. The agronomic trials conducted in three provinces have shown that this highly reactive Gafsa phosphate rock is an effective phosphate fertilizer for several different crops, especially sweet potato, cassava, and canola. This project is funded by the Compagnie des Phosphates de Gafsa Company and will be completed by the end of 2001.

- **Soil Acidification Research**

IFDC researchers continued to monitor the effect of different nitrogen fertilizers (urea, ammonium nitrate, and ammonium sulfate) on acidification of three soils varying in soil properties. In total, five crops (wheat-maize-wheat-maize-wheat) were harvested during a period of three years. During 2000 IFDC scientists conducted a soil incubation study to support the greenhouse experiments in terms of the effect of nitrogen rate on soil acidification. The results from the greenhouse and laboratory studies show that ammonium sulfate was 50%-100% more acidic than urea and ammonium nitrate but much lower than the official Association of Official Analytical Chemists (AOAC) value of 200%. The Honeywell Company funds this project.

- **State of Agroecosystem in Latin America—the International Food Policy Research Institute (IFPRI) Collaboration**

It is often difficult to assess the economic impacts of agricultural development that arise from technology-induced changes in yield potential and/or production costs at the farm level. To address this problem, IFDC scientists developed a DSS linking a GIS, a sequential crop modeling system or DSSAT, and the Dynamic Research Evaluation for Management (DREAM) economic model in a benchmark test in Colombia. Long-term sequential cropping simulations at different technology levels can be compared through the analysis of the biophysical sustainability of a system coupled with the generation of relevant and structured economic information to support decision makers implementing agricultural policy, assigning priorities, and allocating limited resources.

- **Collaboration with the International Potato Center (CIP)**

Two 3-year projects funded by the Ecoregional Fund to Support Methodological Initiatives [Dutch/Swiss funds managed by the International Service for National Agricultural Research (ISNAR)] were successfully completed. One project produced an integrated assessment system that uses remotely sensed data, GIS, and process-based models to evaluate agricultural production in the Altiplano of Bolivia and Peru. The other project developed a decision support system (integrated GIS and economic and biophysical models) to assess tradeoffs between agricultural production and its impact on human health and the environment. A planning grant of $10,000 was also awarded to IFDC/CIP and collaborators in Bolivia, Colombia, Ecuador, Peru, and Venezuela to develop an Andean research network referred to as Management of Soils in the Andes (MOS Andes). The Ibero-American Program for Cooperation in Science and Technology Development (CYTED) funds this project. The principal goal of the network is to implement more sustainable and productive soil management practices in Andean farming systems.

- **Collaboration on Crop Modeling with the National Institute of Agricultural Research (INIA)/Uruguay**

During the early 1990s, IFDC's efforts in South America in the area of simulation models were mainly aimed at the calibration and testing of the models. More recently, the research activities are oriented to develop effective applications of the simulation models. These models are excellent tools for exploring input management strategies, studying the sustainability of agricultural systems, and evaluating the economic and environmental impact of technology.

IFDC activities on this subject are based on the view that, in order to be effective, simulation models must frame the information in broader decision support tools that also include data on such factors as prices, climate, land use, demography, and distance to markets. Consequently, IFDC is developing IDSSs in collaboration with Latin American institutes.

Specifically, IFDC is working with INIA of Uruguay, the National Institute of Agricultural Technology (INTA) of Argentina, the University of Uruguay, the Agronomy Institute of Paraná (IAPAR) of Brazil, the Ministry of Agriculture of Paraná (Brazil), and the National Aeronautics and Space Administration (NASA) to develop an IDSS for the agricultural sector of Uruguay and the state of Paraná. The IDSSs include simulation models for the main crops and pastures of the country, climate outlooks (3-month lead climate probabilistic forecasts), remotely sensed information on weather and crop/pasture production, data on prices and costs, land use, and weather data.

These IDSSs are being developed in areas with ample information on weather, soils, and surveys. This allows the testing of methods to acquire this same type of data in regions with little information (e.g., using satellite data to estimate rainfall and temperature and to determine net primary production in crops, pastures and trees).

- **COSTBOX Project**

One of the goals of the Ecoregional Fund-supported project—"A Client-Oriented Systems Tool Box (COSTBOX) for Technology Transfer Related to Soil Fertility Improvement and Sustainable Agriculture in West Africa" is the introduction, promotion, and use of systems for agricultural research and decision making. To fully appreciate the impacts and constraints of past modeling projects in the region, meetings were held with institutions and individuals who were involved in these efforts. The key reasons cited for poor adoption were lack of training, complexity of the models, unavailability of data, and the irrelevance of the existing models. The COSTBOX Project launched field trials in association with farmers, researchers, and extension personnel in Togo to test the models under field conditions with the full participation of the target users. A workshop on the application of models in their work was also organized for the staff of Togolese research and extension institutes. To produce a policy- and district-level impact, the COSTBOX Project is collaborating with the University of Ghana.

- **Phosphorus Model Development**

  In its effort to improve and expand the applicability of crop simulation models in the developing world, IFDC is collaborating with Michigan State University, the SWNM Program, IAEA, and NARS from Benin, Nigeria, Togo, and India to test the CERES-P Model. Field and greenhouse data are being used to incorporate and test the effects of P deficiency on crop duration, expansion growth, and yield. To further simplify the inputs to the model, pedotransfer functions associated with readily available soil physical and chemical properties have been developed. Future improvements will involve inclusion of a module to handle phosphate rock application.

- **Expert System Development for Phosphate Rock**

  Over the years, IFDC has conducted much research to define agronomic and economic conditions required for the efficient use of phosphate rock (PR) relative to soluble P fertilizers. Despite significant outputs from this research, the information is not available in an easily accessible form that can be used to make recommendations on the feasibility of PR use. Recognizing the need for such a tool, activities were initiated to develop an expert system for determining the feasibility of PR use. The present prototype, which addresses factors affecting agronomic effectiveness—PR reactivity, site characteristics (including soil pH, texture, etc.), and crop species—is currently being tested using IFDC's historical data. The next step will be to expand the prototype to include socioeconomic factors to produce an unbiased tool for determining the feasibility of PR use under various agroecological conditions.

- **IFAD-Funded USG Project in Bangladesh, Nepal, and Vietnam**

  The 3-year IFAD funded project, Adapting Nutrient Management Technologies (ANMAT), aims to obtain resource-poor farmers' adoption of environmentally friendly nutrient management practices (primarily urea deep placement) for paddy production in Bangladesh, Nepal, and Vietnam by providing funding and technical assistance to NGOs. During the first year, more than 10,000 farmers in Bangladesh learned about deep placement of USG through 93 farmer meetings, 53 farmer trials, 17 field days, 20 television and open-air video shows and distribution of leaflets during the 2000 boro season (January-June). Also, four NGOs in Bangladesh interviewed 1,026 farm households in four project-districts to obtain baseline data for measuring project impact at the end of the project. Work was initiated with two NGOs in Nepal during the wet season (June-October 2000) and was begun with one NGO in Vietnam in the 2001 dry season.

- **BARC-Funded Agricultural Research Management Project**

  The National Agricultural Research System of Bangladesh, led by the Bangladesh Agricultural Research Council (BARC), initiated a project conducted by IFDC to strengthen various policy and management aspects of the country's research program. Under a loan agreement with the World Bank, research authorities in Bangladesh have formulated an Agricultural Research Management Project, highlighting the opportunities for gains in the efficiency and effectiveness of the national agricultural research system. The research management consultant assisted in the completion of master plans for the agricultural research institutes. The master plans focus on the seven research management processes: goal setting, objective formulating, organizing, staffing, leading, evaluating, and deciding. A research management information system is an important tool for the final two processes in the management cycle (evaluating and deciding).

Developing Ecologically Sound Agriculture

- **Heavy Metals Research—Cadmium**

  IFDC scientists initiated a study to investigate the granulation (compaction) of potassium chloride (KCl) with a single superphosphate (SSP) having a high cadmium content to determine if this would increase the cadmium uptake by crops (upland rice and soybean) as compared with bulk-blended fertilizers. It was hypothesized that chloride may complex more cadmium from compacted phosphate/potash (PK) granules to form soluble ion-pairs, thereby increasing cadmium uptake because of the close proximity of the cadmium and chloride than that from bulk-blended PK granules. The results show that cadmium concentrations were significantly higher in soybean grain, straw and roots in an acid soil treated with compacted than with bulk-blended SSP-KCl. The same trend was also observed with upland rice straw but not with rice grain. A followup experiment with *Brachiaria* grass is in progress.

  On the basis of research performed at IFDC, a paper entitled "Natural and Agricultural (Fertilizer) Inputs of Cadmium," was presented at the Scientific Committee on Problems of the Environment of the International Council for Science (ICSU) Workshop, "Environmental Cadmium in the Food Chain: Sources, Pathways, and Risks," at the Academy of Sciences, Brussels, Belgium, during September 2000. A recent IFDC paper reviewed natural sources of cadmium including the various types of rock constituting the earth's crust, soils, base-metal sulfide deposits, coal, and phosphate rock. The paper further provided an in-depth analysis of the cadmium contents of various types of phosphate rock deposits, cadmium contents of specific deposits, types of phosphate fertilizer processing and redistribution of cadmium in fertilizer processing, and methods and potential costs of cadmium removal from phosphate rock and phosphoric acid.

- **Carbon Sequestration**

  The main goal of the research activities in carbon sequestration is to develop and test methodologies for estimating carbon balances in agricultural and forestry systems. The emerging carbon market will require methods to estimate, monitor, and verify the amount of carbon being sequestered or emitted in different projects for the agricultural and forestry sectors. IFDC is collaborating with national institutes (INIA-Uruguay, INTA-Argentina) and international organizations (NASA, Colorado State University) to develop and test methods to study the soil carbon dynamics using laboratory measurements in long-term experiments, calibrating and testing simulation models (Century, DSSAT), and remote sensing with different resolutions (normalized difference vegetation index) and other indices at 1-km to 15-m resolution).

Conducting Innovative Training Programs to Strengthen Agricultural and Economic Development

The Human Resource Development Unit conducted 12 international workshops, training programs, and study tours during January 2000 – June 2001. About 284 participants benefited from the programs in the areas of computer modeling and simulation, input marketing, safety in fertilizer production and handling, compound and blended fertilizer production, and policy reform.

International Fertilizer Development Center
2000/2001 Training Calendar

Training Program/Study Tour	Dates	Location
2000		
1. International Training Program on Computer Simulation for Crop Growth and Management Responses	February 21-March 3	India
2. International Training Program on Agricultural Input Marketing	April 3-8	Tanzania
3. International Training Program on Safety in Fertilizer Production and Handling	May 8-19	U.S.A.
4. Advances in Agricultural Production and Fertilization	June 19-30	U.S.A.
5. International Fertilizer Marketing Training Program	August 14-25	Muscle Shoals (U.S.A.)
6. International Study Tour on Compound and Blended Fertilizer Production and Handling	September 11-29	Thailand, Malaysia, Singapore, Australia
7. Economic Policy Reforms and Agricultural Input Markets: Experiences, Lessons, and Challenges	October 16-20	South Africa
8. International Fertilizer Marketing Training Program	November 6-17	Thailand
2001		
1. International Training Program on Agricultural Input Marketing (in French)	February 5-10	Mali
2. International Training Program on Agricultural Input Marketing (in English)	February 19-24	Ghana
3. Workshop on Marketing Skills and Forecasting	April 16-19	Tunis, Tunisia
4. United States Study Tour on Advances in Agricultural Production and Fertilization	June 18-29	U.S.A.

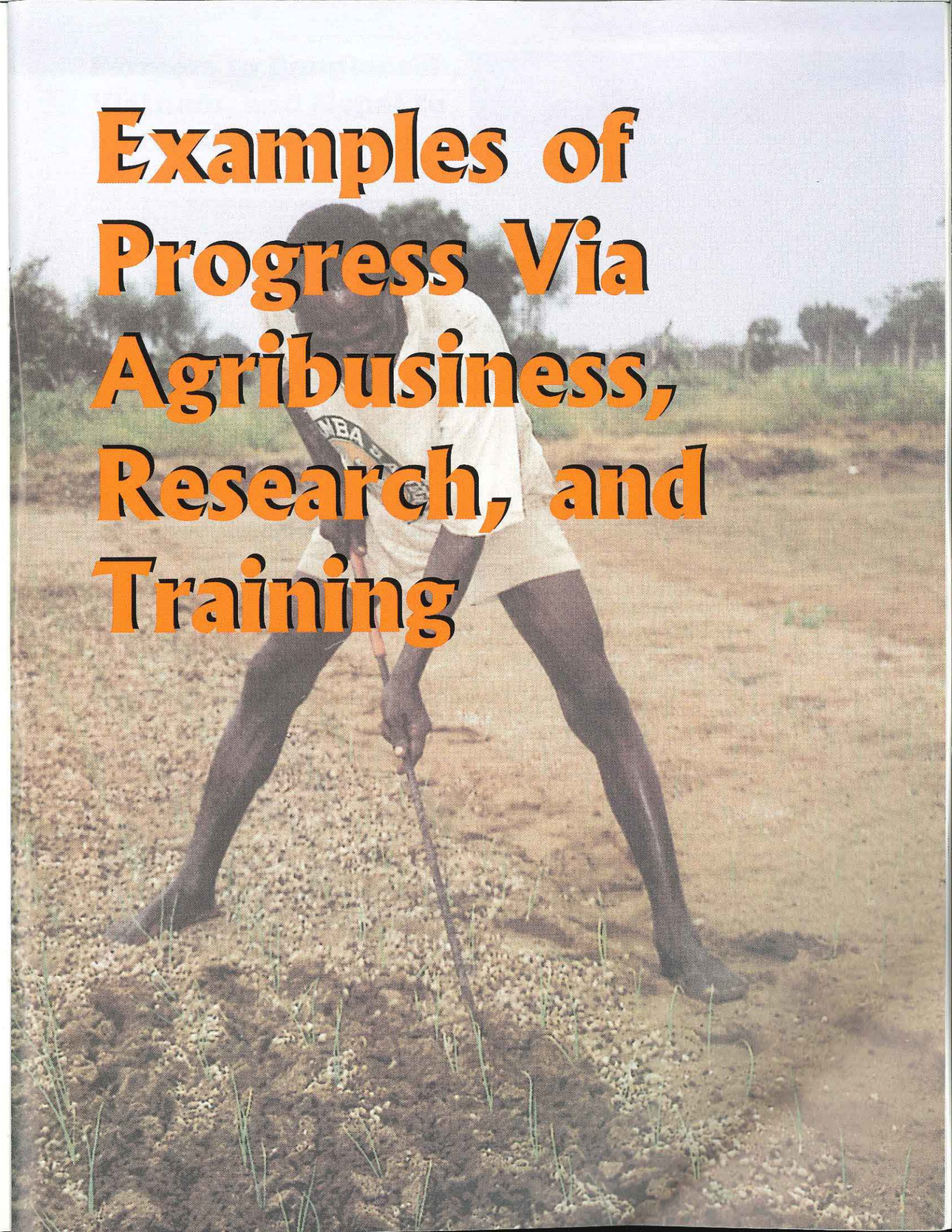
Providing Engineering and Technology Services

During 2000/2001, the IFDC Engineering and Technology Program worked closely with the world fertilizer industry in the development of new or modified fertilizer products to enhance nutrient contents, improve crop yields, and increase benefits to farmers and consumers. In performing these technical assistance projects, IFDC has worked with fertilizer companies in Australia, Northern Ireland, Pakistan, Malaysia, and many other countries, including the United States. In providing technical services to the world fertilizer industry, IFDC strived to achieve maximum productivity with high product quality at the lowest possible cost, using environmentally sound technologies and production practices. During 2000/2001 the Engineering and Technology Program was involved in the design of three new fertilizer facilities in developing countries to provide local sources of balanced nutrient supply.

The Engineering and Technology Program has continued activities in the development and evaluation of strategies to decrease the potential for criminal use of ammonium nitrate (AN) and develop techniques to identify sources for forensic purposes. At the conclusion of two studies of fertilizer trade AN, the success rate in identifying individual AN sources was as high as 97%, depending on the combination of numerical classification and neural network modeling strategies used. Neural network modeling, a computer technique that involves repetitively analyzing data and comparing it with known associations to effectively teach the computer program to perform identifications, proved to be very valuable in the final data analysis. Neural network modeling, as a decision-making tool, may have numerous other applications in fertilizer production and marketing. Neural network modeling may be particularly appropriate in solving complex problems where there are numerous interacting variables and where associations and effects may not be readily apparent using traditional analysis techniques.

Based on the results of the fertilizer-grade AN studies, funding has been provided for a similar study of low-density AN. Furthermore, a study has been funded to explore the technology and determine the characteristics of an AN-based product that may be less sensitive, or insensitive, to detonation.

Examples of Progress Via Agribusiness, Research, and Training



Farmers in Bangladesh, Vietnam, and Nepal to Increase Their Incomes

Vietnamese farmer harvests rice on a rainy day near Hue.

That practice (urea deep placement) is environmentally friendly and permits farmers to obtain higher yields while using less fertilizer N.

Rice is the principal food crop in South and Southeast Asia. Bangladesh and Vietnam rank fourth and fifth in the world in rice production, respectively, and paddy accounts for 95% of each country's total cereal production. Farmers must apply fertilizers to supply plant nutrients to obtain economic yields of rice. Nitrogen is the nutrient that is required in greatest quantity, and urea is the principal nitrogenous fertilizer used for rice production. Unfortunately, N from urea is subject to great losses to the atmosphere and in runoff water in the paddy ecosystem, especially when urea is broadcast into water or on the soil surface. The atmospheric losses occur as ammonia from floodwater and as products of denitrification from soil. Incorporating urea into the water-saturated soil at 7-10 centimeters depth (a reduced zone) minimizes the losses of N in the usual paddy-growing environments by minimizing chances of nitrogen being dissolved in floodwater or being oxidized in soil near the surface. That practice is environmentally friendly and permits farmers to obtain higher yields while using less fertilizer N.

It is practically impossible to incorporate common urea into soils of paddy fields, but urea may be compacted into discrete particles weighing one to three grams (or more) and hand placed into soil after transplanting of seedlings. The method of application is commonly termed urea deep placement (UDP). Extensive research between 1975 and 1990 found that the relative agronomic efficiency from placement of urea particles into soil between paddy plants was considerably greater than the usual practice of split broadcast applications of commercial urea. Studies involving the nitrogen isotope ^{15}N showed that crop recovery at maturity was 60%-70% of deep placed N but only 30-40% for two or three broadcast applications of commercial urea. N unaccounted for (presumably lost) was about 10% of that applied as deep placement but 30%-40% of the broadcast N.

In 1996 the IFDC-implemented ATDP, funded by USAID, began extending urea briquette technology and deep placement through training and technical assistance for the Department of Agricultural Extension (DAE) and NGOs. Small, sturdy, low-maintenance machines were developed that produce 0.9-2.7-g briquette from commercial urea at rates of from 250-1,000 kg/hr through project assistance. The machines are entirely produced in Bangladesh; more than 600 have been sold to entrepreneurs and NGOs between 1996 and April 2001; 303 of this number were sold during FY1999-2000. The DAE estimates that 83,000 mt of briquettes were hand deep placed by Bangladeshi farmers for 335,000 ha of paddy (about 10% of the irrigated paddy area) during FY1999-2000. The Government of Bangladesh has provided strong policy and funding support. DAE reported average yields from 78 demonstrations comparing deep placement at a rate of 77 kg/ha of N with farmer treatment. Deep placement of urea briquettes produced 20% (1,176 kg/ha) greater yield even when farmers reported using 59% more urea in their traditional method.

ANMAT Project

IFDC, with funding from IFAD, is implementing the ANMAT Project, an Asian regional project. IFDC provides training, technical assistance, and funding to NGOs to assist resource-poor farmers to evaluate, adapt and adopt low-cost and environmentally friendly nutrient management practices for paddy production. The project focuses on UDP.

IFDC has initiated work with two NGOs in Nepal and one NGO in Vietnam to introduce UDP through farmer participatory evaluation and adaptation. Similar activities to those in Bangladesh are being conducted within pilot areas in two districts in Nepal and four provinces in Vietnam.

Bangladesh

Project activities are accelerating the adoption of UDP in Bangladesh by supporting four NGOs working in areas where the practice has not been previously promoted. During CY2000 about 2,500 farmers attended training and discussion meetings, farmers established 168 trials and demonstrations, and 2,375 farmers attended field days during plot harvesting. Within the four pilot areas 1,026 farmers participated in surveys to define the socioeconomic and agricultural base at the beginning of the project.

Three NGOs completed 53 farmer trials during Boro season in 5 thanas. In all trials two replications of three treatments were used. Paddy yields (14% moisture) from treatment comparisons were: broadcast urea applied in three split applications (5.32 mt/ha), UDP (6.19 mt/ha) and UDP plus sulfur and zinc (6.14 mt/ha). All plots received N, P_2O_5 and K_2O at rates of 77, 35 and 50 kg/ha. Assigning a value for straw plus grain of Tk10/kg of paddy, the increased value of production from UDP equals Tk 8,700/ha. Increased cost may be Tk 0.5/kg x 167 kg of urea (Tk84) plus Tk70/day x 8 days labor for UDP (Tk560) or Tk644/ha. Then, UDP provides increased profit of Tk 8,056/ha with a benefit:cost ratio of 12.5 for use of UDP. UDP increased the number of active tillers by 20%-34% and yields by 16%-17%. No significant yield responses to sulfur and zinc applications were recorded.

During Aman season four NGOs completed 78 single plot UDP demonstrations and took crop cuts to estimate grain yield from the plots plus from adjacent areas within the farmers' fields. Several plots were not harvested due to crop damage by inclement weather. Mean yields from UDP were 4.52 mt/ha as compared to 3.77 mt/ha from farmers' treatment. While yield increased by 20%, the number of panicles per unit area increased by 23%.

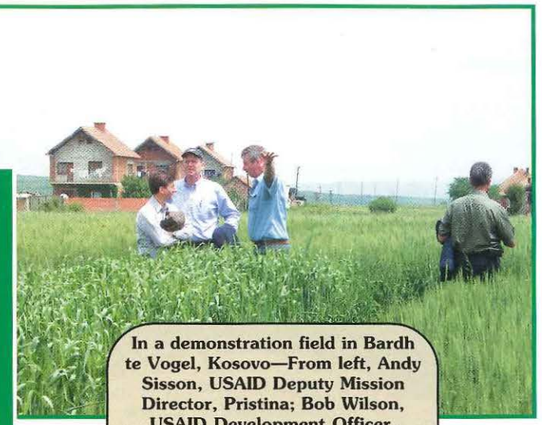
After two crop seasons of work the NGOs reported that 988 farmers purchased about 45 mt of urea briquettes and hand placed them for 253 ha of paddy within the four pilot areas during the CY2001 dry season.

In CY 2001 the original four NGOs are continuing to work within their pilot areas and work was initiated with an additional four small local NGOs. About 50 farmer training and discussion meetings, showing videos and distribution of leaflets, 380 farmer demonstrations and trials and 32 field days are planned during the year. More than 70 trials will include treatments with and without animal and green manure. UDP block demonstrations (5-10 or more farmers cultivating adjacent fields) are being established after training and organizing farmers to apply briquettes, purchased by the participating farmers. During the CY2001 dry season the block demonstrations involve 88 farmers using about 6 mt of USG for an area of 36 ha of paddy.

Nepal and Vietnam

IFDC has initiated work with two NGOs in Nepal and one NGO in Vietnam to introduce UDP through farmer participatory evaluation and adaptation. Similar activities to those in Bangladesh are being conducted within pilot areas in two districts in Nepal and four provinces in Vietnam. During 2001 about 30 demonstrations and trials will be established in a hill area (terraces) and 30 in the southern plains of Nepal. In Vietnam a total of 90 demonstrations (spring and summer paddy) and trials will be established in the plains of three provinces and 12 in mountainous regions of three provinces. The project has purchased and shipped one briquette production machine to both countries.

Kosovars Bolster Their Private Sector Agribusiness System



In a demonstration field in Bardh te Vogel, Kosovo—From left, Andy Sisson, USAID Deputy Mission Director, Pristina; Bob Wilson, USAID Development Officer, Pristina; and Richard Hicks, IFDC Chief of Party/Kosovo

The Kosovo Agribusiness Development Program (KADP) is designed to aid the recovery of existing private agribusiness and promote the development of new private agribusiness ventures by strengthening the productive capacity, efficiency, and overall economic status of those involved in private agribusiness and farming throughout the region.

"Regional free trade and niche marketing are the viable solutions," says Wojtek Mlodziejewski of the Kosovo Department of Trade and Industry. "Kosovo should... learn what to produce and how and where to market it." The senior trade official was one of eight featured speakers during a seminar, which was held in Pristina, Kosovo, on June 14, 2001. The purpose of the seminar, which was organized by IFDC/Kosovo, was to encourage consensus on the important role that agribusiness must play in the future of Kosovo and to discuss how best to set the policy stage for progress and to tackle the challenges facing the sector.

With funding from USAID, since October 1999 IFDC has been working toward the recovery of agriculture and agribusiness in Kosovo. The Kosovo Agribusiness Development Program (KADP) is designed to aid the recovery of existing private agribusiness and promote the development of new private agribusiness ventures by strengthening the productive capacity, efficiency, and overall economic status of those involved in private agribusiness and farming throughout the region. IFDC/KADP is accomplishing these goals by helping to establish private trade associations—modeled after similar, successful associations founded in Albania. These new associations strengthen the ties between individual agribusiness ventures, improve networks of communication and distribution, and facilitate access to credit and financing.

IFDC has helped to establish three of these trade associations since 1999. The membership of the three associations has grown to 440, double that of 2000 and already exceeds the results indicator target of 66% increase set for the project's conclusion. The project helped the associations develop business plans and schedules for fees and dues. This activity will supplement the overall aim of financial sustainability of the associations in the future. Four agricultural trade associations have formed an alliance for the purpose of strengthening their voice for policy change. With project support, the Alliance conducted an important workshop in March 2001 and presented the authorities with well-documented arguments for reducing fiscal disincentives to agribusiness development. In addition, a monthly newsletter by the AKA for trade association members has been launched to enhance communication and education.

The Kosovo Dealers and Agri-Inputs Association (KODAA) is composed of retailers and inputs suppliers. The Kosovo Poultry and Feed Millers Association, the newest of the associations, has grown rapidly. During the first year of the project, the poultry producers made new investments of US $2.3 million, representing a 78% increase over their existing assets in chickens, feed, and equipment. Egg production during the past year is estimated to have increased by 79% and sales revenue by 52%. Finally, the Kosovo Flour Millers Association works with both private and public sector mills. Although credit remains scarce for agribusiness ventures, project counseling has encouraged considerable self-investment and informal borrowing. For example, over the past year, members of the millers' association invested US $1.5 million in refurbishing and upgrading their plants. During 2000, the millers were able to double their gross revenue and triple their net profits.

Members of these organizations have received specialized training, viewed technical demonstrations, attended the "Agrotika" trade fair in Thessaloniki, Greece, and made preparations for future commercial training projects. IFDC/KADP intends to continue

strengthening these associations by increasing membership and benefits.

The intensive campaign since the beginning of the project to promote the availability and adoption of improved agri-inputs is paying off in significant ways. For example:

- Fertilizer use this year (2001) reached 68,000 mt, compared with 40,000 last year (2000) and against a project target of 60,000.
- Seed sales increased from 16,000 mt to 26,000 mt this year (2001), against a target of 22,000 mt.
- Use of crop protection chemicals more than doubled to 66 mt this year (2001); 50 mt was the target.
- Eight new fertilizer products and 12 seed varieties were also introduced.

As a result of improved availability of inputs, project extension services, and many other factors, including weather, average estimated wheat yields increased by more than 50%, from 2.3 to 3.6 mt per hectare. Extension leaders expect the yields to reach 4-5 mt per hectare eventually. The project target for the first year was 17% increase in wheat yields. Maize and potato yields in 2001 will also exceed project targets of 10% and 12% increases.

These efforts provide a gradual, sustainable basis for private sector growth and prosperity in the war-torn region. IFDC's proven success in neighboring Albania helps construct the basic private institutions necessary for the transition to free and open markets. With the project's help, private agribusiness interests in Kosovo will continue along the path of steady transition, elevating efficiency, productivity, and affluence throughout Kosovo's agricultural sector.

Being interviewed in one of the Kosovo demonstration fields is Refki Zogaj (center), President of KODAA association.

"Seeing is Believing" for Kosovar Farmers

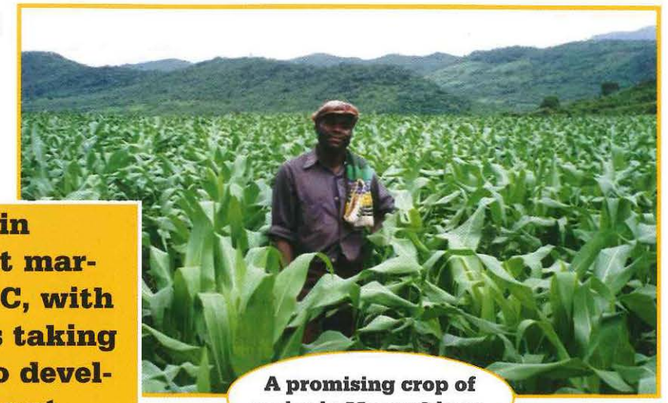
Kosovar farmer, Ibush Krasniqi, can believe his eyes. He is seeing for himself the impact of modern agricultural technology on his field in Bardh te Vogel, Kosovo. Krasniqi's farm was selected as one of the sites for demonstrating the potential yields that can result when the right mix of crop varieties, fertilizer, water, etc., is applied in the right quantities and at the right time. Representatives from USAID, KODAA, and IFDC recently visited the Kosovar farmer's field to see the results of the research being conducted by IFDC. "The extension experts have told me that I can expect a yield of 4-5 tons per hectare from my wheat field," Krasniqi says. "This will be of great benefit to me and my family."

Wheat yields in Kosovo usually average a low of 2-2.5 tons per hectare, which falls far short of satisfying the needs of the country's population. For the past 20 months IFDC has been working in Kosovo to assist in the development of agribusiness and agriculture in that country.

"The extension unit of the IFDC project has organized demonstration fields, like the one on Krasniqi's farm, to find better crop varieties that will produce higher yields for the farmers," says Richard Hicks, Chief of Party, IFDC/Kosovo. "On these fields are planted 25 different varieties from Albania, Mexico, Turkey, Hungary, and the United States. We are trying to determine which varieties are more sutiable for the agroecological conditions in Kosovo; after the completion of the research, the most favorable varieties will be offered to the country's farmers."

The IFDC extension experts are following a process of preparing the land, planting—using high-quality seed, and fertilizing with appropriate fertilizer products. Farmers in the region are very curious about what is going on around them. Almost every day they visit the demonstration fields to see for themselves the results of the research. More than 2,000 farmers and agricultural experts from Kosovo have visited the demonstration farms. The tremendous difference between these demonstration fields and the traditional farms surrounding them is obvious to the farmers; they are anxious to try the new technology. Seeing is truly believing, after all.

Mozambique Invests in Market Agriculture



A promising crop of maize in Mozambique.

To assist Mozambique in strengthening its input market supply system, IFDC, with funding from USAID, is taking a stepwise approach to developing private sector input supply.

Most of Mozambique's 18 million population are dependent on agriculture for their daily needs in a country where infrastructure was destroyed by civil war, input and output markets are rudimentary, and the high production potential areas of the north are difficult to link to the demand centers in the south. In addition, agricultural credit is almost non-existent; shifting agriculture and a lack of access to fertilizers and other inputs is depleting the soil fertility. To assist Mozambique in strengthening its input market supply system, IFDC, with funding from USAID, is taking a stepwise approach to developing private sector input supply. The project is designed to initially provide the most necessary support for private sector development in farm inputs supply. First, the project is leading an improvement of the agricultural inputs regulatory framework and, second, providing for improvements in the supply of improved inputs. The two-year project commenced in January 2000.

Regulatory Framework—Although regulations existed for crop protection products (CPPs) and seeds, the regulations were not conducive to private sector development and technology transfer and no regulations existed for fertilizers. Persuading government officials of the need to develop improvements in the existing regulatory framework was the first activity for the IFDC project. IFDC and regional consultants provided assessments of the existing situation for fertilizers, seeds and CPPs. Close coordination with the Ministry of Agriculture and Rural Development and the private sector has been necessary to develop the recommendations from the assessment reports. Draft ministerial decrees (laws) and the corresponding regulations based on the "truth in labeling" approach have been proposed for both fertilizers and CPPs. Both of these are currently under discussion with the various stakeholders in Mozambique for their inputs in an effort to obtain acceptance and consensus on a broad scale. The final legislation will be achieved shortly. Realistically, the implementation of these new laws and regulations will not be easy initially as some major and minor paradigm shifts must occur in both the public and private sectors. With the very limited current markets in Mozambique it is often difficult to see the need for comprehensive regulatory frameworks but, irrespective of market size, well-formulated laws and regulations are required to foster private sector development and protect consumers and the environment.

Fertilizer Supply—Mozambique has relied on donor fertilizer in the past. The Japanese government initiated a Second Kennedy Round (KR2) program of assistance through the Japanese International Cooperation Agency (JICA). The underlying purpose of the KR2 is to provide the poorest rural farmers access to agricultural inputs, fertilizers, CPPs and machinery or hand tools. This has largely failed due to a wide spectrum of influences. Some of these include the Government of Mozambique not having the capacity to implement this fully; the private agricultural inputs sector was not made an integral part of the process; and most of the small farmers do not have the financial means to utilize these inputs. They also do not have the incentive to increase crop production when output markets are so rudimentary or non-existent.

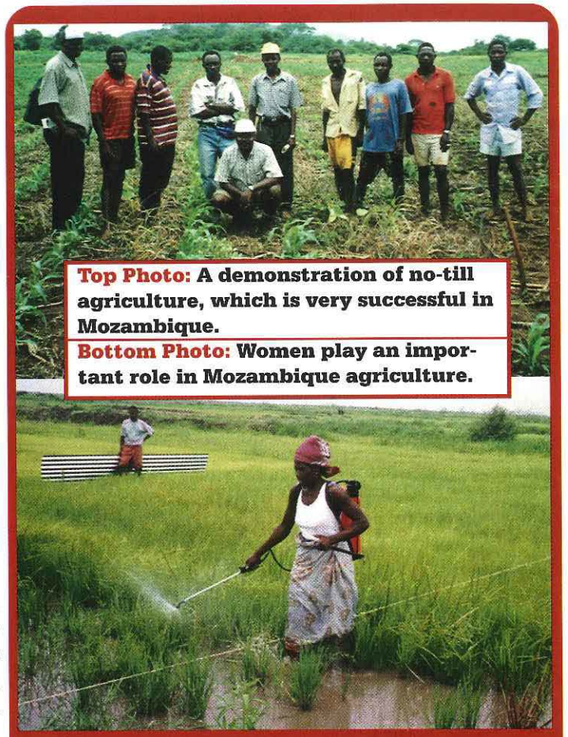
IFDC has been working to develop improvements to the KR2 system with the Japanese and Mozambican governments to make the system more responsive to the real needs of farmers and input dealers. JICA has

now taken a positive step by posting a full-time representative in Mozambique, and this will assist in developing a new KR2 approach that is acceptable to both the Mozambican and Japanese governments and addresses the main needs as described above, including the use of generated funds for rural credit programs for both farmers and input dealers.

In the meantime, IFDC was instrumental in developing the first commercial supply of fertilizers from regional fertilizer producers, even initiating supply on consignment to overcome the chronic credit supply for input dealers and farmers. Although the tonnage involved was small, it represented a start to private sector fertilizer importation in 2001.

Private Sector—The private agricultural inputs sector is slowly developing but the lack of financial resources, the inability to compete with foreign input suppliers' terms and conditions for commercial farm tenders, the small size of the small holder market and the high risks involved in supplying these markets have all curtailed the development of market networks. IFDC is working to develop from this current situation by improving access to donor and commercial sources of input supplies, developing trade associations as development tools, and developing access to credit for agribusiness and farmers. By working with farmer groups established and nurtured by NGOs, IFDC can reduce the risks for the private sector input suppliers.

There is very little doubt that Mozambican agriculture will mature from this developmental stage. The willingness to succeed exists, and IFDC can play an important role in the future to encourage this attitude and to convert the willingness into success.



Top Photo: A demonstration of no-till agriculture, which is very successful in Mozambique.

Bottom Photo: Women play an important role in Mozambique agriculture.

The willingness (in Mozambique) to succeed exists, and IFDC can play an important role in the future to encourage this attitude and to convert the willingness into success.

Albanian Trade Associations Network to Support Agribusiness Development

The fruit and vegetable processing business, EN&ZY, Ltd., is experiencing remarkable growth, thanks to technical assistance from IFDC/Albania.

The (AAATA) project was designed to establish effective and sustainable support structures to assist new agricultural entrepreneurs in the development of prosperous agricultural businesses.

Immediately after privatization of state-owned agricultural processing enterprises in Albania, the new entrepreneurs had no place to turn for technical assistance. Two of these entrepreneurs, Enver Ferizaj and Hiqmet Driza, were soon to be among the beneficiaries of a new technical assistance project that IFDC initiated in their country.

EN&ZY, Ltd.—Case Study in Entrepreneurial Development

Former employee—now owner—of EN&ZY, Ltd., Enver Ferizaj, bought 1.2 ha of land, on which he operates his fruit and vegetable processing company. After continuing with the usual seven-product line, he soon realized that he needed to expand his business market. He turned to the IFDC project—AAATA—for technical assistance. Since that time EN&ZY, Ltd., has realized dramatic growth. The main areas of assistance to the company have included the following:

- Improvement of entrepreneurial skills
- Market research and export possibilities
- Procurement of packaging materials
- Profitability assessment for the portfolio of products
- Upgrade of technical capabilities
- Design and assistance in procurement of new machinery and its installation
- Diversification into new products
- Marketing and launching of new products

EN&ZY, Ltd., one of the founding members of the highly successful Horticulture Albanian Business Association (HABA), has realized the following results from the IFDC assistance:

- Achievement of two contract growers' agreements to produce for processing needs, mainly tomatoes and peppers
- Processing of twenty types of fruits and vegetables, with 90% of supply coming from domestic production of field crops
- During 2000, the company exported 150 tons of tomato ketchup; in 2001, 500 tons should be exported.
- An increase in sales revenue, number of products launched, raw materials processed, investments made, and bank loans obtained. The number of products tripled between1997 and 2000; the sales revenue more than doubled during the same period.
- The company now owns three sales outlets.
- During the past 2 years, the company, with IFDC/AAATA assistance, has obtained two bank loans, worth US $400,000 for working capital; the company has already paid off these loans.

DRIZA, LTD.—Another Case Study in Entrepreneurial Development

When Hiqmet Driza, owner of DRIZA Ltd., entered the Albanian poultry industry in 1997, he faced seemingly insurmountable challenges. Most of the nation's processing facilities were unprofitable because of technological and managerial inefficiencies. Machinery was out of date, and the human capital needed to develop in the new market economy was lacking. For Driza and most of Albania's agricultural entrepreneurs, no institution existed in Albania's business community that was capable of changing these unfortunate circumstances until the launch of the AAATA project into their country.

For entrepreneur Driza, involvement in an AAATA association has resulted in greater access to sources of credit and information, the modernization of equipment, and the overall expansion of his poultry business. After Driza joined the poultry association, his broiler production increased from 95,000 units in 1998 to 550,000 units in 2000, a net increase of 455,000 units. Meanwhile, the projected sales figure for 2001 is six times greater than the figure from 1998, and the company has expanded its distribution networks to serve all of Albania's primary markets. Overall, the poultry association members produced 60% more eggs and 63% more revenue (an increase of US $13.4 million) during the first two years of the project.

A Catalyst for Change in Agribusiness Development

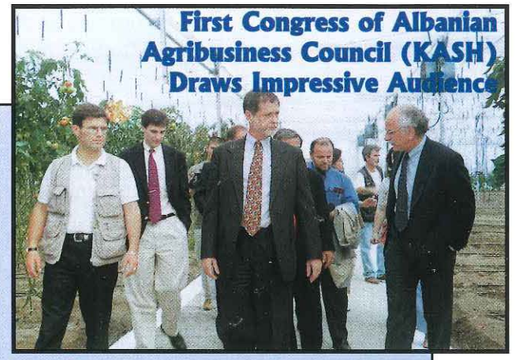
In 1999 the AAATA project was started with an ambitious agenda that facilitated the growth of agribusiness associations capable of improving conditions. The goal of the AAATA project is to promote interest in associations among various agribusiness stakeholders. The project was designed to establish effective and sustainable support structures to assist new agricultural entrepreneurs in the development of prosperous agricultural businesses.

Components of the project include the following:

- Support for trade associations so that they can become effective advocates for policy improvement and provide business and technical information and other services as follows:
  1. A federation of 16 trade associations that have a voice on policy issues.
  2. A business and management center that provides general services.
  3. A support unit that provides technical guidance to eight industry associations.
- Technical and business assistance to agribusiness firms that are members of the associations. Services include access to credit and finance, business planning, expert advisors, and market information. The project staff and local and foreign experts provide technical advice on an industry basis and also according to demand and potential on an individual enterprise level to establish successful pilots.
- A range of support mechanisms for associations and agribusinesses, including the following:
  1. Assistance for public institutions that can work with private firms to improve food quality, marketing, and regulations and with policymakers in supplying reliable statistical information and analysis.
  2. Financial advisory services and credit unions to assist association members in gaining access to credit and investment.
  3. Media tools, including a newsletter and publicity campaigns.

The AAATA project works in an integrated and systematic way through the trade associations to address constraints and to provide needed technical assistance to enable the private sector to increase the quantity and quality of agricultural production on a market-driven basis. By developing and strengthening private business associations, AAATA/IFDC assumed that agricultural businesses in Albania would be able to procure much-needed financing and technology with greater efficiency. The program has worked very effectively and has provided a lasting institutional infrastructure capable of representing and supplying the needs of the agribusiness community. The project has increased membership in the trade associations and provided intensive training, technical and business assistance, and other support to the association members. As a result, the members have significantly increased production and employment, thus contributing to agricultural development and economic growth in Albania. The new associations have become successful policy advocates, representing the legislative interests of their members. They have become sources for inputs—machinery, feed, and seed—which have greatly improved the productive capacity and efficiency in many industries. Perhaps the greatest success of this project, however, has been its sustainability. Although the initial phase of the program was completed in 2000, the trade associations that it sponsored continue operating efficiently, expanding self-sufficiency, and promoting growth among members. In fact, the members have increased their business by 30% in 2000 to a total of US $40 million, three-quarters of it self-financed.

Hopefully, in the next few years, AAATA/IFDC will build upon its past successes, extending the developing institutional support network. The project plans to emphasize the growth of industry clusters in horticultural agricultural processing, greenhouse fresh produce, olive and edible oil processing, and poultry. The Albanian entrepreneurs accept the project's faith in the future of agribusiness. For example, priority agricultural enterprises have invested US $6.8 million of their own funds in the first two years of the project, US $3 million in the second half of 2000 alone. The AAATA project has used its training, advice, and influence to encourage commercial banks to extend US $2.5 million in credit to project clients during the past two years and to motivate outside suppliers of agricultural equipment to provide an additional US $2.6 million in trade credit in the same period. This network will continue to provide advocacy and services to the business community. Meanwhile, the trade associations' example in the development of new techniques and pilot projects, coupled with the continued growth of member businesses, is expected to add momentum to the nation's developing agribusiness sector.



First Congress of Albanian Agribusiness Council (KASH) Draws Impressive Audience

The formation of KASH—the Albanian Agribusiness Council—was a milestone event for private business in Albania," said the U.S. Ambassador to Albania, Joseph Limprecht. "With agriculture accounting for more than half the economy, the need for agricultural businesses to have a strong voice in national affairs is clear. The formation of KASH was also a significant accomplishment of the assistance the United States has provided for many years through IFDC."

Ambassador Limprecht made these comments during the opening session of the first Congress of KASH on May 10, 2001, in Tirana, Albania. In his address, the Ambassador showed that he understands the importance of the meeting. "This is an historic moment for Albania," he said. "Its purpose is to provide a forum for a discussion of significant policy issues. As we near the parliamentary elections, it is critical to have debate on questions about the economy and the policies that will facilitate economic growth. . . . The representatives of the political parties who are here will be able to respond to [the issues discussed]. You will be able to compare their responses and understand the party positions on agriculture. You should be able to judge how their positions could affect your businesses. And the reverse will occur. The parties will learn what issues are important to KASH members. Through this process, KASH can hold the parties accountable for what they say today. This is the essence of democracy."

Besides Ambassador Limprecht, attending the Congress were representatives of five out of nine Albanian political parties, the Minister of Agriculture and Food, World Bank, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Land O'Lakes, Swiss Agency for Development and Cooperation, World Learning, the Rector of Tirana Agricultural University, and representatives of the sixteen member associations of KASH.

Under the auspices of the AAATA project, which is funded by USAID, KASH was founded on September 15, 2000, as an umbrella for 16 member associations. The mission of the organization is to unite as a single voice for advocacy. Through their quarterly regional and national meetings, KASH members assemble to raise advocacy issues, plan strategies, and resolve issues with governmental authorities. The Council supports its opinions based on the real knowledge of the consumers' demands through some 700 businessmen and 25,000 farmers, who invest millions of U.S. dollars in the sector.

During the first Congress of KASH the participants discussed the current and future problems of the agricultural and agri-processing industry development and presented to the Albanian Government decision makers its opinions regarding the following:

- **Necessity of Institutionalization of Cooperation**
- **Problems in Regard to Agricultural Land**
- **Agricultural Product Marketing**
- **Reviews for Improvement of Fiscal System**
- **Credit System**
- **Food Quality and Safety**
- **Struggle Against Corruption**
- **Power Resources**

The first congress of KASH marks the beginning of an organized effort to solve the above problems. KASH will work toward the complete realization of the solutions to these problems. In addition, the organization will inform the interested associations and the public regarding its efforts and negotiations with relevant state agencies.. The further strengthening of KASH through the active participation of its member associations and increasing its membership will contribute to the achievement of these objectives and further enhance KASH's reputation as an indispensable partner in Albania's economic progress.

Bangladesh Takes Off on Agribusiness Highway

Under the auspices of the Ministry of Agriculture, with funding from USAID and implemented by IFDC, the ATDP is widely regarded in Bangladesh as a beacon for agribusiness development.

The ATDP Project in Bangladesh, completed in July 2000, exceeded the expectations for the project. The project played a leading role in transforming attitudes toward agribusiness in that country. Under the auspices of the Ministry of Agriculture, with funding from USAID and implemented by IFDC, the ATDP is widely regarded in Bangladesh as a beacon for agribusiness development. Begun in January 1995, the project aimed to increase productive employment in agriculture and related enterprises through the creation of competitive markets for agro-related inputs, outputs, and technologies. Objectives included policy reform, free flow of capital and technology, diversification and intensification of crop production, and poverty alleviation. The project aimed to encourage market-driven technology development and transfer and to provide agro-entrepreneurs with information and access to credit.

To achieve the ambitious targets, project leadership devised a US $4.5 million development fund from interest generated by a revolving Agribusiness Credit Fund (ACF). The Government of Bangladesh allocated US $26 million for the ACF, which was channeled through commercial banks and monitored by the project. The credit provided vital liquidity and spurred banks to lend to newly developed agro-enterprises. The development fund enabled the project to establish a matching grant program and to double the number of regional offices to eight.

The achievements of the project resulted from a strategy that delivered a holistic, integrated package of services to agribusiness and capitalized on partners to multiply impact. For example, ATDP exceeded or met five of its six primary contractual targets:

- Against a target of 100,000 over the five years, 700,000 farmers adopted more productive, environmentally sound technology (mainly through the use of urea supergranule fertilizer).
- Compared with a target of 80, contract grower arrangements numbered 172.
- Investments/loans made in agribusiness totaled 12,700, nearly double the target of 7,000.
- Representing 2.5 times the goal, US $257 million in credit and investment was realized.
- Versus a target of 130,000, new jobs in agribusiness were created for 70,000 people.
- Over 50 significant policy reforms were enacted.

In early 2000 the Planning Ministry evaluated the project and concluded that it had reached its targets on time and "accomplished its overall objectives." The final evaluation team highlighted specific achievements, including:

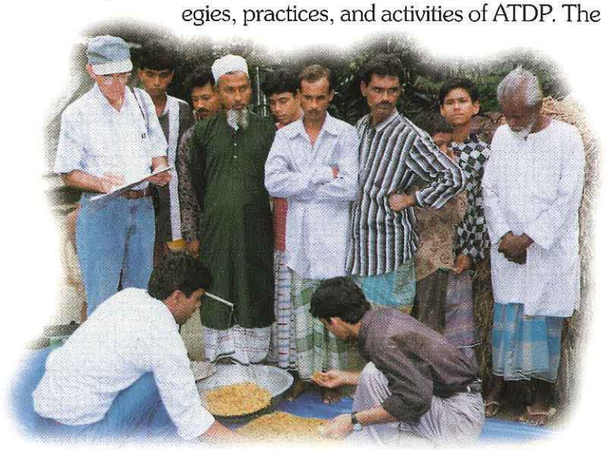
- The improved packaging and pre-cooling techniques introduced by ATDP helped increase vegetable exports by US $5.6 million during 1997-99.
- One business mission sponsored by ATDP for shrimp processors to the United States in 1999 generated US $18 million in spot orders and US $35 million in follow-up purchases.
- ATDP conceptualized "model poultry villages" as a vertically integrated industry and established them in 12 pilot areas. The Government of Bangladesh, nongovernmental organizations and the World Bank praised the idea.

- Introduction of urea supergranules contributed US $23 million to the gross domestic product in 1998/99 and US $86 million in 1999/00 and created employment for 13,350 people.
- ATDP established a federation of agribusiness trade associations.

"In the past agriculture was for subsistence. Now it is an industry. This change has been brought about by ATDP"—President of the Agribusiness Development Organization of Bangladesh, Fakhrul Islam Munshi.

- Thanks to ATDP support to borrowers, the loan recovery rate from credit generated through the ACF-led commercial process is 95%.

In designing another agricultural project, the Asian Development Bank (ADB) borrowed heavily from the strategies, practices, and activities of ATDP. The ADB project preparation mission undertook a detailed analysis of ATDP and concluded "the project has been a catalyst in building confidence in the business and financial community that agribusiness is a good investment opportunity. The policy dialog has contributed to a better business environment."

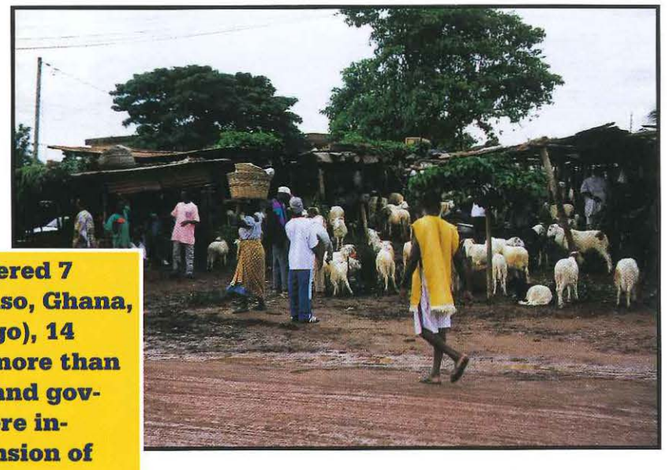


The ATDP was directly responsible for the following:

- Demonstrating how to modernize the potato industry, beginning with better seed through production to storage to successful export to processing French fries.
- Supporting the dynamic growth and diversification of the largest agro-processor.
- Increasing exports of fruits and vegetables for assisted client enterprises—from US $120,000 in 1998 to US $290,000 in 1999 and US $166,000 in the first quarter alone of 2000.
- Working through an NGO named Poverty Alleviation, Gender Equity and Environment (PAGE), in Comilla to help 300 poor farmers, mainly women, begin exporting vegetables to the United Kingdom, and thus raising their incomes by 30%.

The President of the Agribusiness Development Organization of Bangladesh, Fakhrul Islam Munshi, said that ATDP caused a revolutionary shift in attitude about agriculture. "In the past agriculture was for subsistence. Now it is an industry. This change has been brought about by ATDP."

Sub-Saharan Africa Farmers Use New Methods to Produce More Food for Their Families



During 2000 the project covered 7 countries (Benin, Burkina Faso, Ghana, Mali, Niger, Nigeria, and Togo), 14 pilot sites, and 66 villages; more than 1,400 farmers and 19 NGOs and governmental organizations were involved in research and extension of ISFM through the project.

Togbe Sodjedo, a Togolese rice farmer, has seen a marked improvement in the quality of his life since he began participating in an ISFM Project, being conducted by IFDC-Africa, Lomé. Rice growing is the primary activity of farmer Sodjedo, and it appears to be a very profitable one. Because of this activity, he was able to construct a nice house on his compound, to buy additional land (2.5 ha of land, outside the irrigated area), to buy potential sites for housing, to buy a motorized cultivator, and to support his family. Besides rice, he also cultivates 1 ha of maize for home consumption.

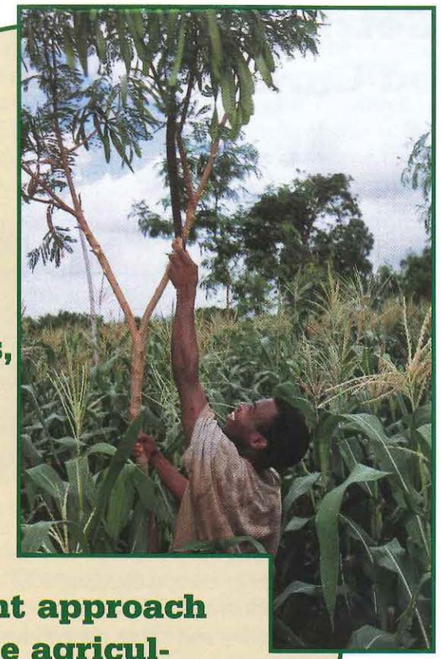
Growing two crops per year on his 3-ha farm to which he applies 1,150 kg of fertilizer, Sodjedo receives a yield of 2,500 kg of shelled rice per ha. For one cropping period, he uses 23 bags (50 kg) of fertilizer, including 16 bags of NPK and 7 bags of urea. This corresponds to a rate of 94 kg N, 40 kg P_2O_5, and 40 kg K_2O on a hectare basis. To measure and manage the amounts of inputs, he uses a bowl. For one plot of 500 m^2, he applies three bowls of fertilizer, which corresponds to about 10 kg, during each fertilizer application. The Togolese farmer has also used indigenous natural rock phosphate and was pleased with the positive results. Of particular benefit to the farmer was the access to credit, provided by the ISFM project, through which he became a member of a self-managed savings and credit system at the village level.

The ISFM project is promoting strategies that include (1) the participatory development of water and soil conservation methods and soil fertility improvement and maintenance methods, e.g., through the combination of organic and mineral fertilizers, (2) the facilitation of rural organization and institution building to improve access of farmers to external inputs and to strengthen their role vis-à-vis decision makers, and (3) input- and output-market development, including credit systems. IFDC-Africa's experiences demonstrate that significant attention should be given not only to participatory research and extension of ISFM techniques as such but also to proper site selection and to participatory approaches for institutional development and for improving linkages between farmers, the private sector, and policy makers at the regional and national levels. IFDC-Africa is working closely with partner institutions, particularly the NARES and NGOs. In fact, IFDC-Africa plays only the role of adviser, coach, and facilitator. The partner institutions are responsible for activities in the field. Initially, the project starts working in some pilot villages to become familiar with the reality farmers are facing and to begin the process of mutual learning. Researchers and extension workers promoting ISFM techniques must be able to translate their ideas and recommendations in a way that is understandable and convincing enough for farmers.

With funding from IFA, Paris, France, and USAID during 2000, the project has made progress in extending ISFM strategies to increase food production at the village and regional levels in West Africa. During 2000 the project covered 7 countries (Benin, Burkina Faso, Ghana, Mali, Niger, Nigeria, and Togo), 14 pilot sites, and 66 villages; more than 1,400 farmers and 19 NGOs and governmental organizations were involved in research and extension of ISFM through the project. The strategic selection of zones and villages that have relative advantages to adopt ISFM strategies and the application of participatory approaches are key elements of the project. Long-term dependency of the farmers on "the project" is avoided. Institutional support concentrated on the organization and management of revolving funds by the farmers themselves, on the marketing of agricultural products, and on the distribution of agricultural inputs (involving both farmers and local input dealers). Pre-extension strategies like farmer-to-farmer visits and "open days" have promoted interest in ISFM strategies in the pilot zones.

As a consequence, the demand for fertilizers, improved seeds, and other agricultural inputs is rising rapidly in the pilot villages. However, for large-scale extension of the project within the pilot zones, more funds will be needed to enable farmers in the pilot zones to increase fertilizer use efficiencies, to train extension agents, and to strengthen professional capacities of the farmers' organizations and input dealers' networks. Inconsistent government policies also often hinder increased and effective participation of the private sector in the market.

Despite these constraints, the project is developing an adequate and efficient approach to stimulate agricultural intensification in well-targeted zones of West Africa. For example, in Mission Tové, Southern Togo, within the irrigated rice-growing area, by using the full integrated package, farmers were able to produce up to 5-6 tons of paddy rice per hectare, compared with only 1.5-4 tons per hectare normally. The farmers preferably conduct mechanized rice growing since this enables them to have two harvests per year. The case of Mission Tové clearly shows that institutional development and the well-functioning organizational structure of farmers are critical conditions for sustainable agricultural development through integrated soil fertility improvement.



Despite these constraints, the project is developing an adequate and efficient approach to stimulate agricultural intensification in well-targeted zones of West Africa.

Getting a Handle on Carbon

Carbon can be sequestered in well-managed grassland soils.

There is thus a clear role for the agriculture sector to help reduce the enhanced greenhouse effect by introducing agronomic practices that result in increased removal of carbon dioxide from the atmosphere.

Fossil fuel combustion and changes in the land use (including deforestation) has resulted in an annual rate of carbon dioxide (CO_2) accumulation in the atmosphere of 3,500 million tonnes. The accumulation of CO_2 and other greenhouse gases is expected to cause observable climatic changes in the 21st century. The International Panel on Climate Change (IPCC) has been publishing assessment reports to governments since the early 1990s. The newest report to be published in 2001 concludes that the global temperature in the 20th century has increased 0.6±0.2°C and that the globally averaged surface temperature is projected to warm 1.4°C to 5.8°C by 2100 relative to 1990. The report also includes observational evidence indicating that increases in regional temperatures have already affected several biological systems around the world.

If the IPCC scenarios turn out to be true, agricultural production will be greatly affected. Research conducted by IFDC scientists and collaborators show that crop yields in several regions of Latin America could be severely reduced under warmer conditions due to shorter crop-growing seasons and increased pest and disease pressure. Moreover, agricultural systems that are already fragile under current climate conditions could become unsustainable under the expected scenarios (e.g., in northeast Brazil and the Sahel in Africa). Recent studies suggest that the most severe impacts on agriculture will be felt around the tropics where most of the least developed countries are located.

Even though it is still difficult to determine how much of the global warming can be attributed to human activity, there is overwhelming agreement that measures should be taken to reverse the current trend of increased accumulation of greenhouse gases (GHG) in the atmosphere. There are basically two paths to reverse such a trend: (1) reducing GHG emissions through cleaner energy generation and (2) removing CO_2 through carbon "sinks" or carbon sequestration.

Regarding the option of removing CO_2 from the atmosphere, IPCC has estimated that agricultural lands have the potential for removing 40,000 - 80,000 million tonnes of carbon over the next 50-100 years. Thus, soil carbon sequestration in agricultural lands alone might offset the effects of fossil fuel emissions and land use changes for 10-20 years or longer. Additional carbon can be sequestered in well-managed forests and grassland soils.

There is thus a clear role for the agriculture sector to help reduce the enhanced greenhouse effect by introducing agronomic practices that result in increased removal of carbon dioxide from the atmosphere. Carbon dioxide is one of the most important gases that enhance the greenhouse effect. It is produced when coal, oil, wood, and other carbon-based fuels are burned. Plants absorb carbon dioxide and through photosynthesis convert it into dry matter (food, fiber, wood). Carbon fixed by plants can remain in the form of wood for several years and/or return to the soil as plant residues increasing the soil organic matter content. The enhanced carbon sequestration strategy in the agricultural sector cannot be viewed as the permanent solution for the GHG emission problem, but it can be an excellent option for "buying time" and allow for the development and global adoption of new, clean and safe energy sources.

Past and recent research has evidenced that reduction in atmospheric carbon dioxide content can be achieved by large-scale applications of land management practices. Among others: reduced tillage, use of pastures (e.g., clovers, alfalfa) in rotation with annual crops, improved strategies to enhance fertilizer use efficiency, increased efficiency of animal feed and return of animal waste, establishment of forests and grasslands in former croplands and degraded soils. Most importantly, increasing sequestered carbon in the soils will provide additional benefits to farmers such as improvement in soil fertility, water-holding capacity and tilth, and reduction in soil erosion.

Two other gases with greenhouse effect are also important in the agricultural sector: nitrous oxide (N_2O) and methane (CH_4). The importance of these gases derives from their warming potential, which is much higher than that of the CO_2 (the global warming potential of methane is about 20 times higher and that of nitrous oxide is 300 times higher than that of CO_2). Nitrous oxide is mainly produced through transformations in the soil of the nitrogen added as fertilizers and/or plant residues. Methane in the agriculture sector is mainly produced as a result of the enteric fermentation occurring in the digestion process of ruminants. A second important role of the agriculture sector contributing to reduce the greenhouse effect is therefore to reduce the emissions of these gases. Since the emission of both gases is the result of inefficiencies in the production system, a reduction of the emissions would also lead to better results for the farmers (higher nitrogen use efficiency and more efficient conversion of animal feed into milk, meat and wool).

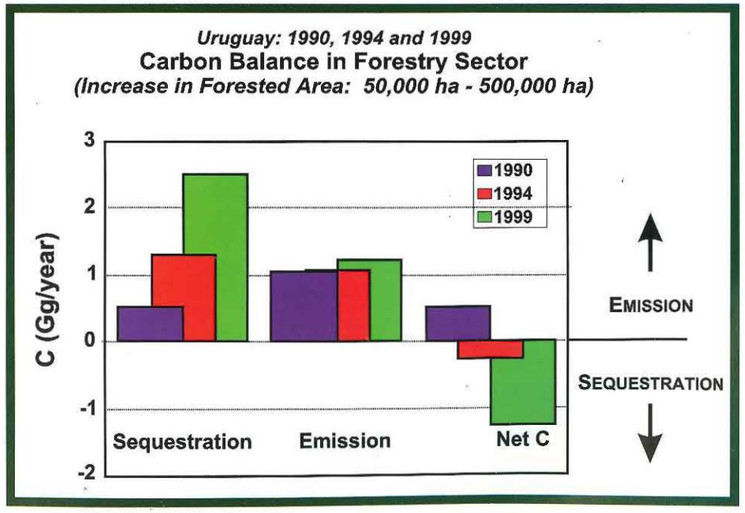
The discussions in the United Nations Framework Convention on Climate Change (UNFCCC) have stimulated an impressive amount of activities all over the world, with the increasing involvement of governments, business people, and scientists. The results of these activities have been impressive, giving shape to the development of an international carbon market.

The shaping of the carbon market can be illustrated by several pieces of evidence. In the first place, several countries are developing legislation to regulate the trading. The most notable case is the Australian State of New South Wales, which has passed the first 'greenhouse' law in the world. Denmark and United Kingdom are also in the process of developing similar legislation. In most cases, trading of certificates generated in foreign countries is admitted as a possibility. One example of this is the recent announcement by the Japanese power company, Tokyo Electric Power Co. (TEPCO), of its starting of a 40,000-ha afforestation project in New South Wales, Australia. This company expects to generate carbon sequestration certificates that could eventually be used as emission permits.

A second piece of evidence comes from the financial sector.The World Bank has just created its US $150-million Carbon Prototype Fund. Some twenty corporations from several industrialized countries have already committed contributions to this fund, which will be used in projects to reduce greenhouse gas emissions in the developing world.

In the third place, several private companies, particularly from the energy sector, are starting to trade carbon reduction certificates. British Petroleum-Amoco has designed its own worldwide internal market. This company has planned a 10% reduction of its emissions by 2010. This target can be achieved by either genuine emission reductions or by purchasing credits from other units. They will also be allowed to obtain carbon credits by investing in external projects.

Examples of how this market is being developed also exist in the agriculture sector. The Canadian consortium of power companies—Greenhouse Emissions Management Consortium (GEMCo)—is paying US $4/acre/yr to several midwestern U.S. farmers for adopt-



ing no-till, a practice that induces atmospheric carbon to be stored into the soil. In exchange, the farmers will allow GEMCo to use or trade the generated carbon certificates.

These experiences lead to the expectation that trading of carbon certificates (or emission-reduction certificates) will be adopted by most countries, probably following the model of the successful U.S. sulfur dioxide market established in 1990. A common feature of projects similar to the ones described above is their win-win characteristic. Activities can be established in a way that all involved parties obtain benefits: the private sector obtains carbon certificates that can be traded to compensate for emissions during the process of adopting cleaner energy sources. The farmers get additional income and improve their soil's fertility and tilth, water-holding capacity, etc. The world ends with an atmosphere containing less carbon dioxide reducing the greenhouse effect.

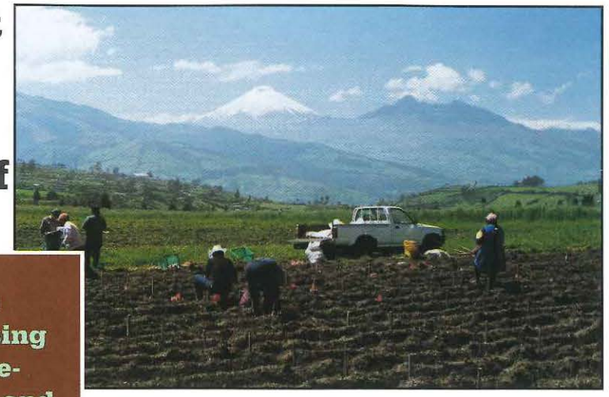
Equivalent projects could be developed by the fertilizer industry. On the one hand, the fertilizer industry can continue efforts to reduce emissions by adopting cleaner industrial processes. On the other hand, the industry can continue supporting research to improve the plant nutrient use efficiency, reduce N_2O emissions from agricultural lands, etc. In addition, the industry can establish carbon market projects in which farmers adopt agronomic practices that result in increased carbon sequestration (using no-till, establishing forests, etc.) and the industry gets carbon certificates that can be traded as emission permits.

One of the possible bottlenecks for establishing a carbon market is the need for accepted methods to measure, monitor and verify the amounts of carbon actually being sequestered in different projects. IFDC and other research institutes are establishing projects in the agriculture sector of different regions of the world to test and implement such methods.

Experiences around the world show that financial incentives can dramatically affect the trends in agricultural production. A good example of this can be found in Uruguay, South America. The government of Uruguay started promoting the establishment of new forests in low-production natural grasslands. A Forestation Law was passed in 1989, which included tax cuts and other financial incentives to farmers who would plant new forests. As a result of that law, the area of new forests has increased almost 8-fold in the last 10 years. Moreover, the results of the last published *National Inventory of Greenhouse Gases of Uruguay* indicated that in 1994 the annual amount of CO_2 sequestered in the new forests compensated for the total annual emissions of this gas from the energy sector. Under the scenario of a developed carbon market, the financial incentives that are now provided by the government could be substituted by the additional income resulting from trading carbon certificates.

In conclusion, scientific evidence indicates that the global temperatures have been rising in the last century and are expected to continue rising in the coming decades. These changes will drastically affect human activities including agriculture. Although it is still difficult to determine how much of the global warming can be attributed to human activity, the current trend of increased accumulation of greenhouse gases in the atmosphere needs to be reversed. The permanent solution for reversing that trend will arise from the development and massive adoption of cleaner, renewable energy sources. However, there is a clear role to be played by the agriculture sector in "buying time" for that change to occur. The development of a carbon market will probably encourage the establishment of projects between industry and farmers, which will lead the latter to adopt agronomic practices that will result in increased amounts of sequestered carbon and reduced emissions of greenhouse gases (such as N_2O and CH_4). This in turn will provide farmers with additional income and improve their production systems and natural resource base. On the other hand, it will allow the industry to reduce their net greenhouse gas emissions during the process of adopting cleaner processes and energy sources.

Maximizing the Impact of Research Through Collaborative Programs: The Tradeoff Analysis Approach



The principal objective of the project is to develop a decision support system (DSS) for assessing tradeoffs (interrelationships) between agricultural production and its impact on the environment and human health within the Andean Ecoregion.

Much of the collaborative research program between CIP and IFDC is being conducted within a larger collaborative program referred to as the Tradeoff Analysis project. This project began during late 1996 with funding from two sources: (1) the Ecoregional Fund to Support Methodological Initiatives (Dutch/Swiss funds managed by ISNAR), and (2) the USAID-funded Soil Management Collaborative Research Support Program (SM-CRSP). This research addresses the need in developing countries to generate the farm and regional-level information demanded by decision makers to assess the sustainability of existing technologies; the potential for adoption of environmentally sustainable technologies; and the economic and environmental consequences of policy decisions for poverty, food security, and sustainability of the agro-environment. Research activities are taking place at the Consortium for the Sustainable Development of the Andean Ecoregion (CONDESAN) benchmark sites in Cajamarca, Peru, and Carchi, Ecuador. The principal objective of the project is to develop a DSS for assessing tradeoffs (interrelationships) between agricultural production and its impact on the environment and human health within the Andean Ecoregion. The DSS, called the Tradeoff Analysis Model, is designed to assist national, regional, and local-level policymakers, rural development professionals, and agricultural researchers in evaluating the regional impact of different policies and technological changes through the statistical aggregation of output from field-scale economic-biophysical models. The Tradeoff Model has the following key features:

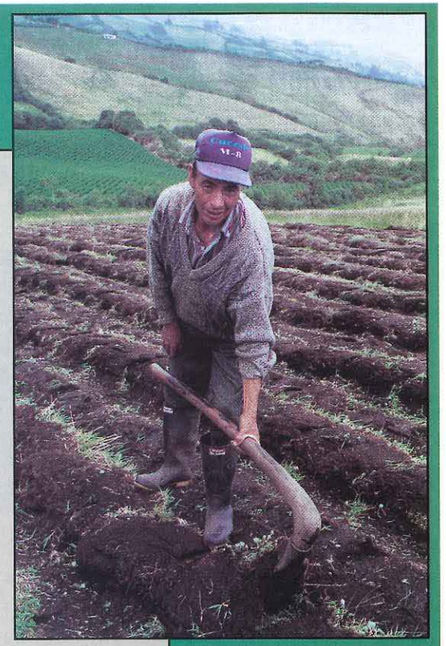
- Provides decision makers with information on tradeoffs between key sustainability indicators under alternative policy and technology scenarios.
- Links disciplinary data and models in a GIS framework.
- Utilizes minimum data necessary for decision support and policy analysis.
- Results can be extrapolated to larger geographic regions in a GIS framework.
- Is transportable: the generic structure of the system can be adapted to other geographic settings and applications.

The first phase of the Tradeoffs Project developed a policy decision support system based on tradeoff analysis of agricultural production systems and applied that system to two watersheds in Ecuador and Peru. The first phase emphasized the development of the Tradeoff Analysis (TOA) method and analytical tools to implement it (data, models and software for their integration). A significant product of the first phase was the Tradeoff Analysis Model computer software that integrates disciplinary data into standard georeferenced formats and provides a modular capability to link existing disciplinary simulation models to support the TOA method.

The TOA method is a process based on collaboration between stakeholders and multidisciplinary research teams. The process begins with identification of sustainability indicators for a production system deemed

relevant by the stakeholders, the formulation of hypotheses about their interrelationships (tradeoffs), and the development of technology and policy scenarios to be assessed. The search team generates suitable data and parameterizes models to quantify sustainability indicators. These models are used to assess how tradeoffs among sustainability indicators respond to technology or policy scenarios. Stakeholders and researchers use this information to assess impacts and design strategies to improve the economic viability and sustainability of production systems. In the first 5-year phase of this research project, the TOA method was implemented in Ecuador in collaboration with the National Research Institute in Agriculture and Livestock (INIAP) and in Peru in collaboration with the national soil conservation program, Programa Nacional de Manejo de Cuencas Hidrográficas y Conservación de Suelos, Peru (PRONAMACHS), and INIA to assess tradeoffs associated with pesticide leaching, water and tillage erosion, terracing, agroforestry, and related soil management technologies. These applications provided the first tests of the TOA method and TOA Model software.

Stakeholders and researchers use this information to assess impacts and design strategies to improve the economic viability and sustainability of production systems.



In addition to IFDC and CIP, the principal collaborators on the project include Montana State University, Wageningen Agricultural University, McMaster University (Canada), the national agricultural research institutions in Ecuador and Peru, regional universities, and NGOs.

Marketers Gain New Insights in Ghana and Mali Agricultural Input Marketing Training Programs

During January 2000-June 2001, IFDC conducted 12 international workshops, training programs, and study tours.

Participants in agricultural input marketing training program in Ghana.

The task of providing more effective fertilizer supply systems in the developing countries is a complex endeavor that involves the development and transfer of improved technology, increased investments in agricultural support systems, and more effective use of existing and improved technology in three areas: (1) fertilizer production, (2) fertilizer distribution and marketing, and (3) fertilizer use. Success in these areas, in turn, depends on the availability and effective use of trained manpower. For the foreseeable future, in the developing countries there will continue to be a severe shortage of trained manpower to meet the wide range of fertilizer-related research and technical needs. In recognition of the need for trained personnel by the fertilizer sector of developing countries, IFDC made a commitment to the task of contributing to training and developing professionals to work in all areas of the fertilizer sector and thereby overcome or at least relax the technology transfer constraints to fertilizer use.

During January 2000-June 2001, IFDC conducted 12 international workshops, training programs, and study tours. About 284 participants benefited from the programs in the areas of computer modeling and simulation, input marketing, safety in fertilizer production and handling, compound and blended fertilizer production, and policy reform.

During 2001, two IFDC training programs conducted in Africa focused on agricultural input marketing. The programs conducted in Mali and Ghana concentrated on the challenges in developing countries and in transition economies in marketing of agricultural inputs in more liberalized, competitive and open markets and the development of techniques and skills necessary for customer-oriented marketing.

The programs covered such topics as marketing concepts in open and competitive markets; international and regional fertilizer situations; pricing in free markets; dealer network management; promotion, market development and advertising; demand and sales forecasting, market planning; and international trading.

The first program, which was held in Mali, was conducted in French. Twenty-seven participants from six African countries—Cameroon, Côte d'Ivoire, Guinea, Mali, Rwanda, and Senegal—registered for the program. They included manufacturers, suppliers, and distributors from the private sector; policymakers; research and nongovernmental organizations. Mali's Secretary General of the Ministry of Rural Development presided over the opening ceremony; he discussed the alarming decline in soil fertility and the associated risk of greater food insecurity; the need to significantly increase the use of productivity-enhancing inputs such as fertilizers, quality seed, and crop protection chemicals; and the increasing critical role of the private sector in supplying these inputs.

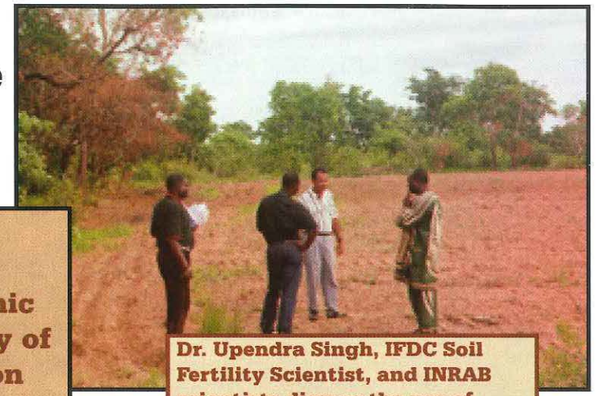
The second program, which was held in Ghana, attracted 32 participants from 11 countries—Ethiopia, Ghana, Japan, Malawi, Nigeria, Pakistan, Tanzania, Togo, Uganda, Zambia, and Zimbabwe. In addition, Mr. Norio Shimomura, Deputy Managing Director of

JICA, attended as an observer during the first two days. Ghana's Honorable Minister of Food and Agriculture, Major (Rtd) Courage E. K. Quashigah, inaugurated the program. Highlighting the program was a field visit to a banana plantation and irrigation project.

Participants in agricultural input marketing training program in Mali.

The task of providing more effective fertilizer supply systems in the developing countries is a complex endeavor that involves the development and transfer of improved technology, increased investments in agricultural support systems, and more effective use of existing and improved technology in three areas: (1) fertilizer production, (2) fertilizer distribution and marketing, and (3) fertilizer use.

Decision Support Tools Spark More Sustainable Production



Dr. Upendra Singh, IFDC Soil Fertility Scientist, and INRAB scientists discuss the use of decision support tools in sustainable production of maize/groundnut rotation in Benin.

The question is, how can we most effectively assess the biophysical and socioeconomic appropriateness and viability of management interventions on agricultural production, soil fertility improvement, and environment.

Decision making for agricultural production is becoming more complex because of increased competition caused by globalization of agriculture and the need to adopt more sustainable management practices. The question is, how can we most effectively assess the biophysical and socioeconomic appropriateness and viability of management interventions on agricultural production, soil fertility improvement, and environment—a process that takes time and makes the trial and error approach too risky and expensive? The Information Management and Decision Support Program achieves the following:

- Promotes development, testing, and implementation of methodologies for adoption and diffusion of systems applications targeted toward resolving soil fertility depletion—one of the most urgent problems undermining the potential for agricultural development in West Africa.
- Develops and applies decision support tools for recommendations on the use of phosphate rock, legumes, and integrated soil fertility management.
- Applies information decision support tools to quantify trade-offs and complementarities in agricultural systems, evaluate long-term effects of management strategies on sustainable production and environment protection.

One of the key concerns is that low adoption of information technology in the developing world, particularly sub-Saharan Africa, may widen the gap between these countries and the developed world. We aim to achieve the promotion and adoption of the use of systems tools for decision-making by:

- Supporting the research and development programs;
- Synthesizing available knowledge and making it accessible to clients in usable forms;
- Translating and transferring knowledge from one place to another for development of packages for integrated intensification and multiple goal planning.

Two projects that specifically target SSA are:

- Application of Decision Support Systems for Nutrient Replenishment and Integrated Nutrient Management under CNDC, and
- A COSTBOX for Technology Transfer Related to Soil Fertility Improvement and Sustainable Agriculture in West Africa.

The CNDC was formed to work with researchers, extensionists, and farmers to combat nutrient depletion based on the principle that the restoration and maintenance of the soils of sub-Saharan Africa is fundamental to sustainable development in the region. The objectives of the project are:

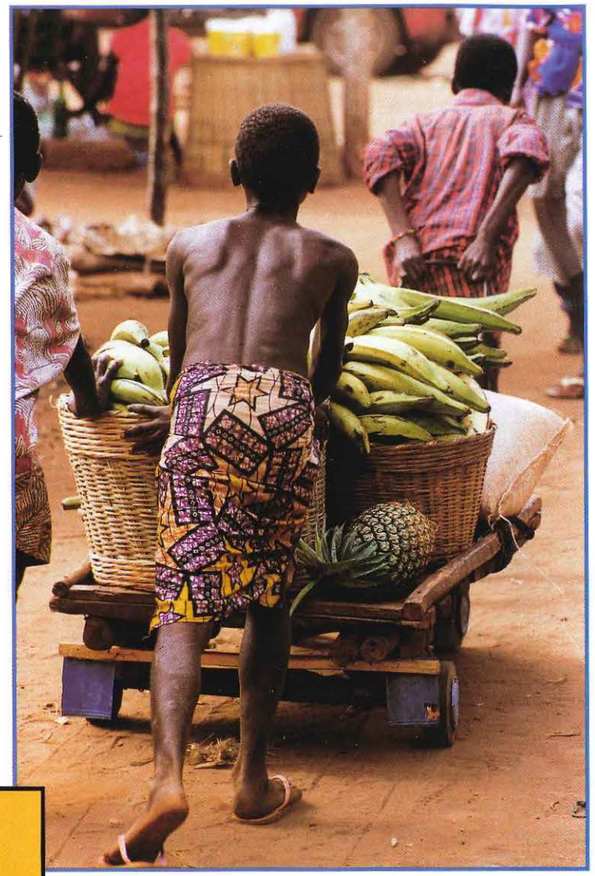
- Use a systems approach to achieve greater impact from ongoing research.
- Coordinate and complement nutrient dynamics research in West Africa.
- Gain practical experience on application of crop growth models to sub-Saharan situations.
- Improve accessibility and availability of soil, climate, crop, and socioeconomic data.
- Work toward developing, adapting, validating, and applying decision support systems in integrated nutrient management research.

- Apply simulation models toward development of sustainable production systems with regard to cropping, nutrient balance, and the environment.

In spite of several efforts, the use of models has remained limited in West Africa. This led to the formulation of the COSTBOX project: "A Client-Oriented Systems Tool Box for Technology Transfer Related to Soil Fertility Improvement and Sustainable Agriculture in West Africa." The project is financed by the Ecoregional Fund to Support Methodological Initiatives." The project started with a survey in seven African countries to better understand the causes of the poor adoption of models. The results of the survey indicate the following:

- Modeling projects emphasized the development of models rather than introducing models for practical use.
- Little time was given for training.
- Modeling was rarely part of the curriculum of the faculties of agriculture.

The COSTBOX project attempts to introduce user-friendly models that address the field level, such as DSSAT, Quantitative Evaluation of the Fertility of Tropical Soils (QUEFTS), and COTONS, a cotton model. Workshops have been organized in Togo, Benin, and Nigeria (Zaria) to acquaint research staff with these models and to discuss with the participants how they could use models in their present work. Some participants were chosen to constitute an expert group in their institutes to provide support to researchers desiring to use models in their work. These expert groups will continue to receive further training.



One of the key concerns is the low adoption of information technology in the developing world, particularly sub-Saharan Africa may widen the gap between these countries and the developed world.

The interdisciplinary systems approach also strives to achieve better linkages and integration between IFDC programs and among field scientists, users of decision support tools, and tool developers to achieve the primary goal of our research—sustainable and productive agricultural systems.

A recent good example of the impact of DSS is found in India. A former IFDC visiting scientist, Dr Sanjay Patil states, "After creation of this new state (Chhattisgarh) there has been continued emphasis on boosting the horticulture in the state for improving the economical status of farmers. I used the DSS to identify suitable areas for horticultural crops and preparation of a comprehensive horticulture development plan. The Government has sanctioned a sum of Rs 2,500 million (about US $55 million) to the state, based on this plan for development of horticulture in the selected regions. This is a good success for a DSS." Knowledge-intensive technologies that lead to greater efficiency are site-specific, thus the cost of developing such technologies relative to likely impacts may be high and require significant time for clients to learn, manage, and make decisions.

Malawi and Nigeria Lay Groundwork for Developing Agricultural Input Markets

The efficient distribution of these inputs—physical supplies, efficient marketing, and technical information—is essential to the improvement of agricultural production and economic status in these developing nations.

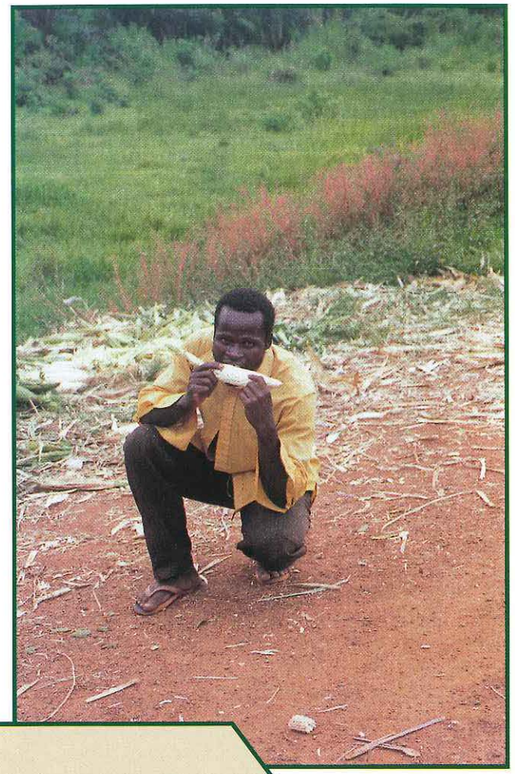
The Honorable State Minister of Agriculture, Government of Nigeria; Head, Project Coordinating Unit; and the Permanent Secretary, Federal Minister of Agriculture and Rural Development discuss the action plan for developing Nigeria's agricultural input markets.

In an effort to promote food security and environmental protection by developing well-functioning agricultural input markets (AIMs) in sub-Saharan Africa so that farmers can have easy and affordable access to inputs, an assessment team composed of IFDC, the Government of Nigeria, USAID, IITA, and WARDA conducted studies of the agricultural input supply systems in Nigeria and Malawi. The efficient distribution of these inputs—physical supplies, efficient marketing, and technical information—is essential to the improvement of agricultural production and economic growth in these developing nations. Both Nigeria and Malawi have made progress in the past few years toward liberalizing input supply systems, but both nations' systems currently operate much less efficiently than optimum, increasing the cost of inputs and decreasing their effective use.

The study team assessed the present situation in Nigeria and Malawi. For example, fragmented markets concentrated in urban or semi-urban areas contribute to high input costs for farmers in rural communities. These costs translate into lower rates of fertilizer usage, lower food production, and the depletion of valuable soil nutrients. Problems within the networks that distribute physical resources are paralleled by difficulties in disseminating intellectual resources—the marketing information and technical skills necessary for the efficient operation of the free market systems. Despite recent liberalizing trends, public monopolies of the past have discouraged the development of human capital in two ways. First, the removal of incentive limited both technical innovation and the willingness of potential investors to enter into free market competition. Second, public enterprises have discouraged the development of market-oriented technical skills and information networks. Finally, the team identified the macroeconomic policies of many developing nations as primary sources of instability in the newly organized markets. Lacking a strong currency or sources of credit and fearing the potential for loss in unstable economic situations, many are discouraged by the potential risks involved in the development of private enterprise.

The measures suggested by the study team were designed to elevate the existing level of market competition, which should increase the coverage of distribution networks, decrease prices to farmers, and increase productivity. First, each nation should strive toward effective policy formation designed to limit the risks to which private investors are subjected. To promote greater security for the investor and a sense of fair competition, the assessment team recommended that those industries existing under public control should either be privatized or have protective subsidies and perquisites removed. Next, the team recognized that under-developed human and capital resources contribute to scarcity and proposed that public sector programs be directed toward the development of effective training seminars and methods of disseminating market information. Finally, to encourage investment despite economic instability, the study proposed that a separate fund be established by each nation to provide credit and foreign exchange support for investors involved in importing agricultural inputs. With all of these measures, the team hopes to encourage greater private investment in agricultural input systems, which would lead to increased access to these inputs and lower costs to farmers.

The specific strategy proposed by the assessment team in Nigeria encompasses a holistic approach, designed to facilitate growth throughout the supply chain by building upon existing structures. In economic and fiscal matters, the team identified Nigeria's unstable currency, which greatly increases the risks of investment, as the macroeconomic issue most inhibiting to the growth of the nation's input systems. The study team suggested a dual approach to improving macroeconomic policy and increasing investor confidence. First, the Nigerian government should enact new monetary and fiscal policies that stabilize irregularities in the value of the domestic currency. Second, physical and financial infrastructures should be improved, reducing input costs and increasing profitability to both suppliers and farmers. Third, prevailing policy distortions should be removed. In addition to these economic policy improvements, the study team suggested the establishment of an Agricultural Inputs Business Development Fund (AIBDF) to provide financing to dealers.



The assessment team seeks to complement new economic and financial components with new sources of legitimate business and technical information, which are vital to the improvement of Nigeria's input markets. To meet these holistic goals, the team suggested a series of measures designed to improve communication and confidence among stakeholders. Market transparency, the development of human capital, and the enforcement of quality control regulations were chief concerns. The team recommended that the Federal Government of Nigeria (FGN) lead to the creation of a marketing information system to collect, analyze, and disseminate information to investors. To promote proficiency in increasingly difficult fields, the study suggested a series of training programs designed to communicate technical and business skills to suppliers. Finally, to ensure that fair and accurate product information reaches the public, the study recommended the strengthening of quality control regulations and, more importantly, their consistent enforcement.

Market transparency, the development of human capital, and the enforcement of quality control regulations were chief concerns.

Collaboration With SG2000 on Fertilizer Assessments in Uganda, Mozambique, and Tanzania

The purpose of each study was to assess the status of the fertilizer market, including use levels, adequacy of input dealer networks, credit facilities, and donor activities related to input market development.

Realizing the importance of fertilizer in sustaining soil fertility and enhancing agricultural productivity, IFDC, in collaboration with SG2000, conducted studies during 1998-2000 in three countries in east and southern Africa—Uganda, Mozambique, and Tanzania. The governments of each of the three countries designated counterparts to participate as study team members. The purpose of each study was to assess the status of the fertilizer market, including use levels, adequacy of input dealer networks, credit facilities, and donor activities related to input market development. Constraints to improved market performance were identified, and strategies for development of the fertilizer market were proposed.

The three countries have a number of characteristics in common, including (1) policy environments that are being liberalized; (2) private sector participation that is very limited and the fertilizer market in each country that is in an early stage of development with associated deficiencies, e.g., limited dealer network, lack of technical advisory services, fertilizer use that is primarily on cash crops, fertilizer prices that are very high by world market standards, credit availability for dealers that is essentially nonexistent, lack of information on fertilizer markets—domestic and international, and donor supplies that account for a significant share of annual fertilizer imports.

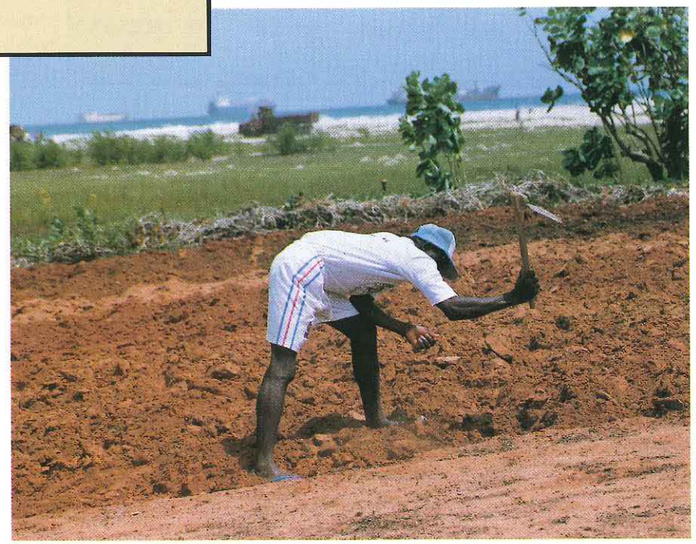
In contrast, each of the three countries has a unique history in terms of fertilizer use. For example, Tanzania in the early 1990s used about 150,000 tonnes of product per year. Subsequent subsidy removal and the collapse of the state farms contributed to a decline in use to about 60,000 tonnes of product in 1999. Similarly, in Mozambique fertilizer use totaled about 100,000 tonnes of fertilizer in the 1980s; however, due to the civil war and the absence of any effort to develop the private sector, use declined to about 5,000 tonnes of fertilizer in 1999. In Uganda, fertilizer use peaked in the early 1970s at about 25,000 tonnes of product per year. Subsequent civil disorder resulted in the collapse of the fertilizer market and, even after the past several years of stability, fertilizer use totaled only 12,000 tonnes of product in 1999.

The potential for fertilizer market development is very good in each of the three countries. All are heavily dependent on agriculture for economic development and a large share (70%-85%) of the population is employed in agriculture-related activities. There is a growing awareness at the highest levels in Government in each of the countries of the critical role of fertilizers in improving crop production. The respective Governments have in recent years opened up the market to private-sector investment; each is seeking to initiate policy reform to encourage private-sector investment. Private-sector interest in engaging in fertilizer supply and marketing activities is increasing. The Government of Japan is evaluating the impact of the KR2 Program and reassessing procedural issues related to integration of the inputs in the markets of the recipient country. Finally, there is a growing awareness of the need to improve the agri-input dealer access to credit facilities.

Clearly, there now appears to be an excellent opportunity to pursue a holistic approach to agri-input market development in these countries. Mozambique has contracted with IFDC to assist the Government of

Mozambique in reform of the KR2 program and design of the regulatory system. In addition, it is understood that the World Bank has made arrangements for work to address the market development opportunities in Tanzania.

Clearly, there now appears to be an excellent opportunity to pursue a holistic approach to agri-input market development in these countries.



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FSR-1 *Africa Fertilizer Situation.*
FSR-2 *Asia Fertilizer Situation.*
FSR-3 *Latin America Fertilizer Situation.*
FSR-5 *North America Fertilizer Capacity.*
FSR-6 *Eastern Europe Fertilizer Situation.*
FSR-7 *Worldwide Urea Capacity Listing by Plant.*
FSR-8 *Worldwide DAP and MAP Capacity Listing by Plant.*
FSR-9 *Worldwide Potash Capacity Listing by Plant.*
FSR-10 *Worldwide Ammonia Capacity Listing by Plant.*
FSR-11 *Worldwide Directory of Fertilizer Traders, Importers, and Organizations.*
FSR-12 *A Guide to Fertilizer Products for Traders.*
FSR-14 *Worldwide Ammonium Nitrate and Calcium Ammonium Nitrate Capacity Listing by Plant.*
FSR-15 *Recent Fertilizer Project Announcements: Worldwide.*
FSR-16 *Global and Regional Data on Fertilizer Production and Consumption, 1961/62-1998/99.*
FSR-17 *World Fertilizer Supply/Demand Situation.*
FSR-18 *Western Europe Fertilizer Situation.*
FSR-19 *Former Soviet Union (FSU) Fertilizer Situation.*
FSR-20 *North America Fertilizer Situation.*
FSR-21 *China Fertilizer Situation.*
FSR-22 *Worldwide NPK Capacity Listing by Plant.*
FSR-23 *Worldwide Phosphoric Acid Capacity Listing by Plant.*
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Financial Highlights, 2000

The following is a summary of financial information for the year ended December 31, 2000. The full financial statements and the independent auditors' reports are available from IFDC upon request.

Balance Sheet

For the year ended December 31, 2000

	US $'000
Assets:	
Cash and cash equivalents	784
Short-term investments	62
Contributions receivable	946
Contracts receivable, net of allowance for doubtful accounts	707
Other receivables	135
Supplies inventory	123
Prepaid expenses	14
Total current assets	2,771
Buildings and equipment, net	1,739
Contributions receivable, noncurrent	
Total assets	4,510
Liability and Net Assets:	
Current portion of lease payable	20
Accounts payable	301
Accrued annual and sick leave	338
Deferred revenue	40
Total current liabilities	699
Unrestricted net assets	3,532
Temporariliy restricted	279
Total liabilities and net assets	4,510

Statement of Revenue and Expenses

For the year ended December 31, 2000

	US $'000
Revenue and Support:	
CGIAR/Centro Internacional de Agricultura Tropical	75
FMC Corporation	343
International Fertilizer Industry Association	212
International Fund for Agricultural Development	538
IMC Corporation	102
Ecoregional Fund	109
Netherlands Minister for Development Cooperation (DGIS)	793
The Fertilizer Institute	154
The World Bank	403
U.S. Agency for International Development	7,231
U.S. Department of Treasury	281
Training Programs	222
Others	861
Total revenues and support	11,324
Expenses:	
Field programs	1,712
Research	2,451
Outreach	5,402
Support activities	1,959
Total expenses	11,524
Decrease in unrestricted net assets	**(200)**

IFDC's Revenue Sources, 2000/2001

Bundesministerium für Wirtschaftliche Zusammenarbeit of the Federal Republic of Germany (BMZ)

Cape Fear Resource Conservation and Development, Inc.

Cargill, Inc.

CCM Fertilizers Sdn. Bhd.

CGIAR/Centro Internacional de Agricultura Tropical (CIAT)

CGIAR/International Food Policy Research Institute (IFPRI)

Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)

Ecoregional Fund

European Agency for Reconstruction

FMC Corporation

Food and Agriculture Organization of the United Nations (FAO)

Government of Bangladesh

Government of Malawi

Government of Togo

Instituto Nacional de Investigación Agropecuaría (INIA), Government of Uruguay

International Fertilizer Industry Association (IFA)

International Fund for Agricultural Development (IFAD)

IMC Corporation

Japan International Research Center for Agricultural Sciences (JIRCAS)

Netherlands Minister for Development Cooperation (DGIS)

Sasakawa Global 2000

The Carter Center

The Fertilizer Institute (TFI)

The World Bank

United States Agency for International Development (USAID)

United States Department of Agriculture (USDA)

U.S Treasury Department

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Constant Dangbégnon, Scientist – Extension

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2. Retired during 2000/2001.
3. Short-term personnel, 2000/2001.
4. On extended leave.

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b. Virginia Polytechnic Institute and State University.
c. Seconded to IFDC by Agricultural University (Netherlands).
d. Seconded to IFDC by Deutsche Entwicklungsdienst (DED).
e. Seconded to IFDC by German Centre for Immigration and Migration (CIM) facilitated by GTZ.
f. Seconded to IFDC by Internationale Agrarische Hogeschool (Netherlands)

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Dhaka
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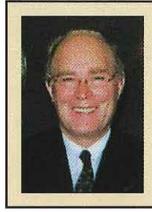

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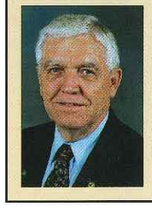

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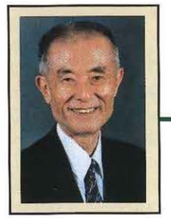

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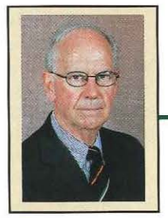

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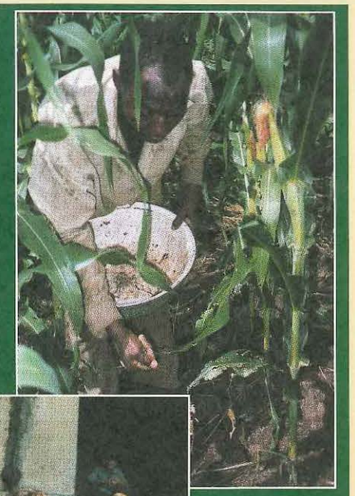
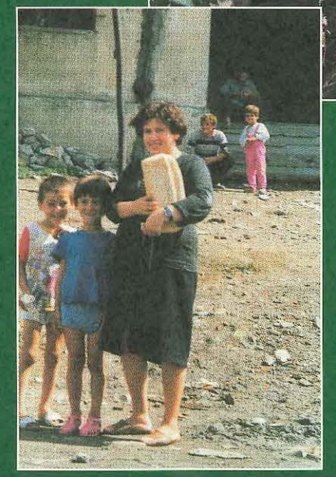
Structure

IFDC's organizational structure is comprised of the following four operating divisions:

1. Research and Development; this division conducts strategic and applied research and training in nutrient management and soil fertility, crop modeling and fertilizer policy;
2. Outreach; this division concentrates on technical assistance and technology transfer and training to improve efficiency of the fertilizer and agriculture sectors;
3. IFDC-Africa, located at Lomé, Togo; this division addresses the constraints to improving soil fertility and agricultural productivity of countries in Africa, particularly those in the western region;
4. IFDC-Asia located in Dhaka, Bangladesh; this division concentrates on improving input and output marketing in the South and Southeast Asian countries.





In addition to these divisions, the Human Resources Development Unit coordinates global training programs and workshops. The Finance, Administration, and Support Services Unit coordinates the accounting, personnel, purchasing, word processing, graphics, library services, support services, and visitor relations for IFDC.

Locations and Funding

Besides its Headquarters in Muscle Shoals, AL (U.S.A.), IFDC has offices and/or staff stationed in Albania, Bangladesh, Belgium, Burkina Faso, Ecuador, Kenya, Kosovo, Mali, Mozambique, Togo, Uruguay, and Washington, DC (U.S.A.). The Center collaborates with the international agricultural research centers (IARCs), numerous national organizations, private-sector and nongovernmental organizations around the world. Partners and clients are diverse and include bilateral and multilateral development agencies, host-government institutions, and private enterprises. Much of the Center's revenue is generated from long-term, donor-funded, market development projects through which its staff members transfer policy and technology improvements in emerging economies.

Vision

The vision of IFDC focuses on contributing significantly to food security and economic progress by promoting sustainable agricultural development across the world through the efficient and environmentally sound management of plant nutrients in conjunction with other agricultural inputs and natural resources.

Mission Statement

To facilitate the sustainable improvement of agricultural productivity through the development and transfer of effective and environmentally sound plant-nutrient technology and agricultural marketing expertise.