

Report

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

IFDC Scientist Uses Climate Forecasts Associated With El Niño in South America to Predict Crop Yields

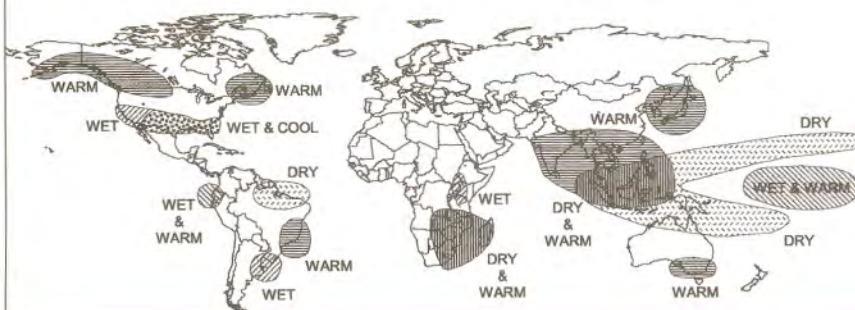
Seasonal climate variability is a key factor affecting human development. Societies, cultures, and economies in the world's history have successfully developed by mastering their abilities to adapt to climatic conditions. Consequently, temperature or precipitation anomalies have often resulted in catastrophic consequences, particularly if such anomalies were not predicted. Although public or media attention has often focused on extreme events, climate variability can also have subtler consequences but with significant economic impacts.

Countries are usually unprepared to cope with climatic anomalies in an effective way; a typical reason mentioned by decision makers for the lack of risk management policies has been the lack of means to predict climate conditions with sufficient skill and lead time. In certain regions of the world, this is changing dramatically due to recent advances in the capacity to predict climate anomalies linked to the onset and intensity of a warm or cold event as part of the El Niño/Southern Oscillation (ENSO) phenomenon (ENSO is a multiyear cycle of the ocean-atmosphere system in the tropical Pacific). These subjects are relevant for agriculture because El Niño and La Niña also impact the global atmospheric circulation in many regions of the world. These impacts, for example in rainfall and temperatures, strongly depend on the season and the geographical location.

The ability to forecast sea surface temperatures in the El Niño region 3-6 months in advance and the effect of this phenomenon on the climatic patterns of some regions of the world is now allowing physical scientists to develop climate outlooks one to two seasons in advance. This ability in turn constitutes a significant challenge for agricultural scientists to apply these outlooks for adapting production systems to reduce losses under expected unfavorable conditions and to maximize benefits under expected positive conditions.

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Warm Episode Relationships December - February



Warm Episode Relationships June - August



IFDC Report

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An IFDC scientist, Dr. Walter E. Baethgen, posted in Montevideo, Uruguay, is involved in climate change research. "In recent years, IFDC has been developing and establishing Information and Decision Support Systems (IDSSs) in an attempt to develop systems that apply advanced technologies to analyze a vast volume of information but which can still be user-friendly for all agricultural decision makers," Baethgen says. "Specifically, we are using modern information technology tools to analyze and transfer information to agricultural decision makers. IFDC's information systems use existing farm-level databases, results of previously conducted field experiments, remotely sensed data, applications of simulation models, automated land evaluation systems and Geographic Information Systems. The applications of these IDSSs result in drought alerts, crop yield forecasts, recommendations of optimal input use, evaluation of the sustainability of production systems, and crop zoning."

These IDSSs are excellent tools to apply the information being generated in climate forecasts associated with El Niño. An excellent example is the improvement of crop yield forecasts, which are very useful tools for agriculture-sector decision makers. When such forecasts are available to farmers before crops are planted, they can use the information to select crop and soil management practices that can reduce risks of financial losses or take advantage of favorable expected conditions. Government agencies can use crop production forecasts to manipulate national crop programs, anticipate expected food requirements (e.g., in famine early warning systems for developing countries), and estimate grain exports or imports. Finally, information on crop yield forecasts is very useful for agents in world grain trade and marketing.

"Traditionally crop forecasts have been based on surveys in primary crop-producing regions throughout the growing season," Baethgen says. "This method presents several limitations: because robust forecasts require intensive surveys in the agricultural regions, they are expensive. This constraint has been partially overcome by advances in remote

sensing; however, this type of forecast becomes available after the crop is planted and typically 1-2 months prior to the harvest, i.e., after all the production decisions have been made."

A typical reason mentioned by decision makers for the lack of earlier crop forecasts has been the lack of means to predict general indicators of climate (e.g., precipitation, temperature) with adequate skill and lead time. This situation has changed dramatically due to advances in the capacity to predict climate anomalies linked to the ability to forecast the onset and intensity of a warm phase or a cold phase in the ENSO phenomenon. IFDC is now incorporating climate forecasts in its IDSSs, which result in better and earlier crop yield forecasts and in greater efficiency in planning input use in agricultural production systems.

"During the past 2 years, IFDC has been collaborating with the National Oceanic and Atmospheric Administration (NOAA), the National Aeronautics and Space Administration (NASA), the International Research Institute for Climate Prediction (IRI) and several national research institutes to study the impact of climate variability on the agriculture sector of the U.S.A. and southeastern South America," Baethgen says. "Results of these studies have indicated, for example, that the probability of obtaining high maize yields in Uruguay is almost three times as large in El Niño years as in La Niña years. Furthermore, if ENSO and climate forecasts are made available to farmers before planting, they can tailor crop management practices according to the expected seasonal conditions."

IFDC is currently orienting its efforts to include ENSO forecasts and climate outlooks in its IDSSs and in the development of better tools for considering this information in the decision making process of stakeholders acting at different levels of the agriculture sector. IFDC is also collaborating with international organizations and national centers to organize periodic meetings in which climatologists develop regional climate outlooks and agronomists, hydrologists, and health specialists discuss possible applications of the information in their sectors. ☉

IFDC to Publish Findings Regarding Soil Fertility and Land Productivity in Mali

IFDC recently completed a study, which resulted from research that the Center conducted over several years in Mali. The study will soon be published as an IFDC technical bulletin entitled *An Evaluation of the Strategies to Use Indigenous and Imported Sources of Phosphorus to*

Improve Soil Fertility and Land Productivity in Mali. The authors of the publication are two IFDC scientists—Dr. Julio Henao, Senior Scientist—Biometrics, and Dr. Carlos A. Baanante, Director of the Research and Development Division. The scientists' findings concerning the agronomic and economic performance of phosphate sources in Mali indicate that phosphate fertilizers are indeed needed for the production of food and cash crops and that Tilemsi phosphate rock is a suitable indigenous source of phosphorus for the sustainable production of important cropping systems in Mali.

Estimates of private and environmental benefits show that investments in the application of Tilemsi phosphate fertilizer can be profit-

able for farmers even when rates of discount are as high as 30%. However, poor rainfall in some semiarid areas and the sudden decline in prices of crop output could make this investment unprofitable to farmers. The important magnitude of environmental and social benefits associated with the use of Tilemsi phosphate rock shows that investing in the application of the fertilizer is highly profitable at the community and country levels. These results show that such an investment will, in the long run, improve the welfare of farmers and the conservation of natural resources. In the short run, however,

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IFDC to Conduct International Environmental Workshop in Prague, Czech Republic

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

This workshop is the fifth in a series of environmental workshops that IFDC has conducted over the past 8 years. In India the Center conducted the International Workshop on the Environmental Impact of Ammonia and Urea Production Units during 1991. In 1992 IFDC conducted the International Workshop on Phosphate Fertilizer and the Environment in Tampa, Florida (U.S.A.). In 1993 the International Workshop on the Environmental Issues of Nitric Acid-Based Fertilizer Production and Farm-Level Use was held in Belgium. During 1997 IFDC conducted in Atlanta, GA (U.S.A.) an International Workshop on Environmental Challenges of Fertilizer Production—An Examination of Progress and Pitfalls.

"In view of the technological progress made worldwide in achieving an increased level of environmental stewardship in the fertilizer production sector, an appraisal of the progress and pitfalls encountered by the fertilizer production industry in Central and Eastern Europe in responding to existing and emerging environmental challenges is timely," says James J. Schultz, Workshop Organizer. "In cooperation with the cosponsors, IFDC is pleased to provide the industry and other stakeholders an opportunity to participate in this international workshop, which focuses on an analysis of the environmental issues facing the fertilizer production industry in Central and Eastern Europe."

The workshop will also discuss the current and future environmental agenda and regulatory climate in the region, in addition to the industry's response to that agenda. Trends in product mix and raw material sources and their impact will be discussed; methods for increasing energy use efficiency in fertilizer production will be highlighted.

The workshop will also include an examination of the broader issues, for example, (1) the impact of fertilizer production on climate change; (2) impact of farming practices, cropping patterns, and diet preferences on required fertilizer products and production technology; and (3) environmental and economic benefits of "advanced" fertilizers tailored to specific cropping systems.

For further details and a registration form, contact the Director, IFDC Human Resource Development Unit, by e-mail: hrd@ifdc.org; by telephone: 256-381-6600; or by postal mail: P.O. Box 2040, Muscle Shoals, AL 35662 U.S.A.🌐

drastic fluctuation in prices and climatic conditions can result in short-term financial losses for farmers. Therefore, in areas with greater uncertainty about rainfall and in crops with low price stability, it is more difficult (risky) for farmers to invest in the phosphate rock or any other source of phosphorus.

Investment in phosphate fertilizer is necessary and a crucial component to restore, maintain, and enhance soil fertility and the conservation of natural resources in Mali. However, it is important to emphasize that investments in complementary technologies for erosion control, water conservation, and use of organic fertilizers should be considered as part of investment packages for soil fertility restoration and conservation.

Given the long-term nature of investments in the exploitation of phosphate rock deposits and the benefits that phosphate rock can provide to the farmers, credit and price policies should be established and maintained for several years as part of any program to promote the sustained use of Tilemsi phosphate rock in Mali.

Serious consideration should be given to the implementation of pilot projects to promote in properly identified target areas the use of Tilemsi phosphate rock for direct application as a component of fertilizer use strategies more suitable to the agroecological and socioeconomic circumstances of each location. These strategies will contribute to the enhancement of soil fertility and the conservation of natural resources in the agricultural regions of Mali. In designing fertilizer use strategies, provisions should be made regarding the effects that adverse fluctuations in climate and market prices may have on profitability and farm income. This is particularly important for investments in phosphate fertilizers because the effects of phosphate fertilizers on soil fertility and crop production take place during several years. ●

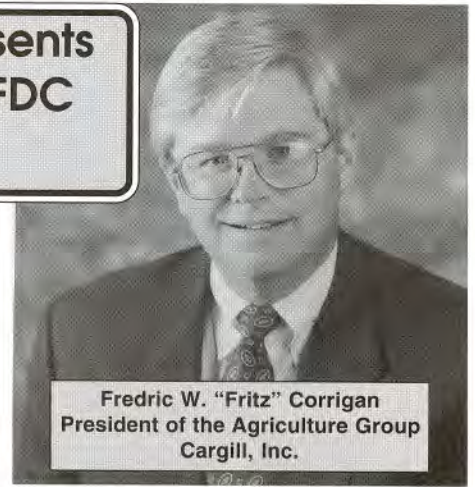
Cargill Executive Presents Keynote Address at IFDC Training Program

The tools for meeting the world's food needs will be biotechnology, information, and freer trade," said Fredric W. "Fritz" Corrigan, President of the Agriculture Group, Cargill, Inc., Minneapolis, Minnesota (U.S.A.), during his keynote presentation to the participants in IFDC's 22nd Annual "International Fertilizer Marketing Training Program," on Monday, August 3, 1998. Cargill is a worldwide agribusiness having a significant nitrogen and phosphate production capacity, with international fertilizer-trading and distribution networks.

The keynote speaker outlined for the participants his ideas on the production of "Better Crops Through Technology in the 21st Century." "Improvements in agriculture have been proven to trigger economic improvements everywhere else," he said. "With improvements in the efficiency of the agriculture sector, people not only eat better. . . but they also have more money to spend on other things."

Corrigan emphasized the importance of working together to share knowledge in an increasingly complex world. He reminded the training participants from 11 countries that agriculture is in the midst of great change and illustrated how we are just beginning to discover methods of unlocking all of the value that is hidden within a kernel of corn or a soybean.

"The IFDC training program will enhance your understanding of the four P's of marketing—product, place, price, and promotion, but I would like to add another letter to the mix: "K" for knowledge," Corrigan said. "Because knowledge is going to be more important than ever for us to be successful in the 21st century, our customers need to know more in order to be successful. We at Cargill have had to continually improve the way we provide them with that knowledge."



Fredric W. "Fritz" Corrigan
President of the Agriculture Group
Cargill, Inc.

Corrigan reminded the participants that farmers are being overloaded with information and choices, and they need assistance in sorting out this information. To be successful, he says, farmers need good solid advice that they can trust.

In this regard Cargill has initiated several new programs to bring more and better information to farmers. "In creating AgHorizons our goal is to provide a world of local solutions to farmers by harnessing all of the agronomic, risk management and marketing knowledge available within Cargill and applying it to their local cropping situations," he said. "Our world of local solutions theme is designed to sort through all the facts to get more truth for farmers—and to get it quickly and easily. In these powerfully fast-changing times, farmers and the companies that serve them need to start using the tools of modern technology to farm profitably and in an environmentally friendly way."

Precision agriculture is another type of technology that Corrigan highlighted as having great potential in the future. "Precision agriculture uses satellite technology to divvy up farmers' fields into tiny grids," he said. "Then soil samples from each of these grids are taken and analyzed prior to planting. The whole idea is to begin managing farm operations by the grid rather than by the field. As the name suggests, it is a more precise way to maximize yields."

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After soil samples are acquired from the grids, the appropriate types and amounts of fertilizers and herbicides can be recommended. The concept focuses on increasing the soil nutrients and other chemicals only where they are needed; this is achieved through variable-rate applicators. It costs about US \$8 per acre to apply nutrients in this manner.

"Another way that agriculture is becoming more knowledge-based is through the advent of biotechnology," he said. "Biotechnology has spawned a whole new type of corporation—the 'Life Sciences Company'—one that harnesses the power of living organisms—plants, animals, and microorganisms to produce goods and services for mankind."

Corrigan was recently tapped to head Cargill's Agriculture-Biosciences Group. This includes the company's fertilizer and seed businesses and its newly created Biosciences Division, whose mission is to find new uses for all of the agricultural products that the company has traded and processed for so many years.

Corrigan is also Chairman of the Board of Cargill Fertilizer, Inc., and a director and member of the Executive Committee of Saskferco Products, Inc., a Canadian joint venture with the Province of Saskatchewan's Crown Investment Corporation. He is Chairman of The Fertilizer Institute's Board of Directors and a member of its Executive and Trade Policy Committees.

In closing Corrigan issued a challenge to the participants in the 4-week IFDC training program: "I hope that you can help remove some of the obstacles that inhibit the movement of goods, services, and the free flow of ideas around the world. Agriculture was a late comer to world trade liberalization negotiations . . . and it has a long way to go. But along with new technology and new information—intensive crop management practices, agriculture needs open borders that allow food areas of need." ☉

Potential Use of Calcined Calcium Iron Aluminum Phosphates for Flooded Rice Production

Traditionally, apatite (a form of calcium phosphate mineral) deposit on Christmas Island in the Indian Ocean has been mined and sold for chemical acidulation or direct application on plantation crops (e.g., oil palm, rubber) grown on acid soils. Other phosphate minerals in the forms of calcium iron aluminum phosphates such as crandallite, millisite, and barrandite over the apatite layer are also present on the island. However, these phosphate minerals are not suitable for chemical acidulation process and conversion to conventional water-soluble phosphate fertilizers because of their high iron and aluminum content. These phosphate minerals also are not suitable for direct application because of their very low reactivity. Consequently, several million tonnes of these phosphate minerals have been stockpiled on the island as waste materials.

"Recently, IFDC conducted a research project for the company, Christmas Island Phosphates, to determine how these calcium iron aluminum phosphates can be used in crop production," says Dr. S. H. Chien, Senior Soil Chemist. "By calcining these phosphate minerals at relatively low temperatures, the water of hydration in the mineral structure is driven off and the minerals become amorphous, thereby significantly increasing their reactivity. Through calcination, the neutral ammonium citrate solubility of crandallite/millisite at 550°C can be increased from 0.5% without calcination to 28.4% P₂O₅ calcined at 550°C and from 5.3% without calcination to 39.6% P₂O₅ for barrandite calcined at 350°C. Because the solubility of these calcined phosphate

minerals increases with soil pH, they are potential sources of phosphorus nutrient for food crops grown on phosphorus-deficient high pH soils. These materials are even more soluble under reduced conditions found in flooded rice soils due to the reduction of ferric iron to ferrous iron. Mineralization of soil organic matter in flooded soils may also enhance the dissolution of these minerals by combining with cations released from calcium iron aluminum phosphate minerals."

Results from IFDC's greenhouse experiments conducted during 1996-98 showed that these calcined phosphates were agronomically effective in increasing grain yield of flooded rice. In a slightly acid soil (pH 6.2), calcined crandallite/millisite phosphates were as effective as water-soluble triple superphosphate (TSP) by increasing rice grain yield from 31.9 g/pot with control to 58.9 g/pot at a rate of 50 mg P/kg. In an alkaline soil (pH 7.8), calcined crandallite/millisite and barrandite increased rice grain yield from 9.5 g/pot with control to approximately 50 g/pot at 50 mg P/kg rate. Based on the same rates of phosphate applied, the calcined crandallite/millisite and barrandite were 83% and 95% as effective as TSP, respectively, in this alkaline soil.

"Depending on the cost of calcination, these calcined calcium iron aluminum phosphates may represent the opportunity to convert what was once considered to be a 'waste material' into an agronomically and economically viable phosphate fertilizer for flooded rice production, especially for farmers in southeast Asia," Chien says. ☉

Workshop and Study Tour Focuses on Fertilizer Production Alternatives

Thirty-six participants from 13 countries were attracted to IFDC's International Workshop and Study Tour on NPK Fertilizer Production Alternatives during October 19-30, 1998. The program consisted of a week each of workshop and study tour. The workshop was conducted at Headquarters, and the study tour included visits to fertilizer production, storage, handling, and marketing operations in Alabama, Georgia, and Florida.

"The workshop and study tour were designed for technical managers and engineers engaged in operating NPK plants and process and equipment design engineers involved in engineering and supply or modification of NPK fertilizer plants," says David W. Rutland, IFDC Senior Fertilizer Technology Specialist, who served as one of the program managers. "Marketing managers of NPK fertilizer production facilities, procurement and distribution specialists, and entrepreneurs contem-

plating the establishment of NPK production facilities also found the program very useful."

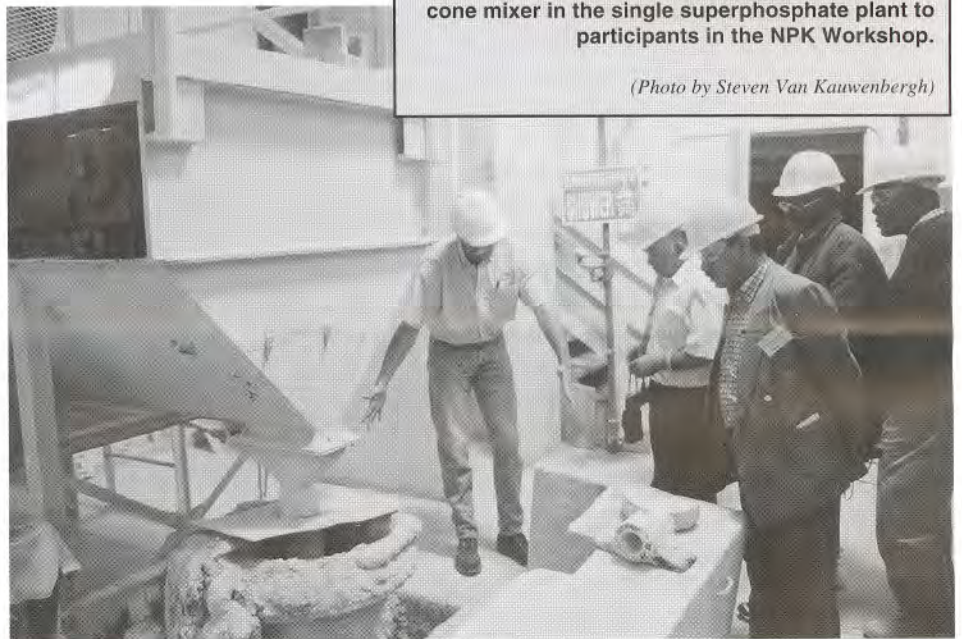
The faculty included IFDC engineers and fertilizer production specialists with a broad range of practical experience in NPK plant design and production technology. Invited experts from the fertilizer industry and equipment manufacturers also participated as faculty.

"The workshop segment of the program included technical presentations, discussions, and practical demonstrations in IFDC's pilot plants," says Steven J. Van

Kauwenbergh, Coordinator of IFDC's Engineering and Technology Program and another of the program managers. "The program covered a wide spectrum of subject-matter topics, including the technology and design criteria for the production of conventional granulated NPKs and urea-based NPKs, bulk blends, compacted NPKs, and fluid NPKs. Some additional topics were marketing considerations for granulated, blended and fluid NPKs; production quality control; and environmental considerations in the design and operation of the production facilities."Ⓜ

Will Sellars, NPK Granulation Plant Manager, IMC, Americus, Georgia, describes the operation of a cone mixer in the single superphosphate plant to participants in the NPK Workshop.

(Photo by Steven Van Kauwenbergh)



IFDC and Sasakawa Global 2000 Collaborate on Studies in Sub-Saharan Africa

IFDC and Sasakawa Global 2000 (a joint program of the Sasakawa Africa Association and the Global 2000 program of the Carter Center) have joined hands to conduct studies and develop action-oriented programs to alleviate policy-related and other constraints on fertilizer use and supply in sub-

Saharan Africa. Under this partnership fertilizer sector assessment studies have already been conducted in Mozambique and Uganda, and the third study will be conducted in Tanzania in May-June 1999. In Mozambique and Uganda, local USAID offices also provided partial funding support for these studies.

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Members of the IFDC/SG2000 team, Dr. Balu L. Bumb (left), IFDC Senior Economist, and Daniel Kikoyo (far right), an official with the Ugandan Ministry of Agriculture, discuss the issues related to farm input supply in Uganda with employees of the Masaka Farm Input Supply Store in Masaka, Uganda.

(Photo by John H. Allgood)

These studies have identified that dysfunctional and fragmented fertilizer market, organizational vacuum, inappropriate handling of fertilizer imports under donor programs, underdeveloped commodity and financial markets, and lack of marketing and management skills are primary constraints on fertilizer use and supply in these countries. IFDC and SG2000 are working with donors and national policy makers to develop policies and programs to alleviate these constraints. 🌐



Announcements

Dr. Georges Dimithe joined IFDC Headquarters in October 1998 as an economist. He comes to IFDC from Michigan State University (MSU), where he served as Visiting Assistant Professor with the Food Security Project, Department of Agricultural Economics. Prior to his work with MSU, he served as Agricultural Economics Researcher with the Cameroon National Institute of Agronomic Research.

Arnoldus J. Maatman joined IFDC-Africa in August 1998 as a sociologist. For the past 10 years at the University of Groningen, Netherlands, he has been conducting research on problems of food security, rural development and agricultural production and on policies to increase food security in West Africa.

G. Scott Simpson joined IFDC Headquarters in August 1998 as a senior marketing specialist. He comes to IFDC from the Tennessee Valley Authority (TVA), where he served as an agricultural economist in the Land and Water Sciences Branch for 20 years. His professional experience is in the area of managerial economics, marketing and distribution of products and technology, market assessment/feasibility analysis, program evaluation and analysis of agricultural commodities.

Dr. George A. Kennedy joined IFDC in November 1998 as Senior Industrial Chemistry Specialist. Previously he worked for TVA for 23 years as a chemist with the Environmental Research Center on research projects to solve technical problems in the electric power utility and fertilizer industries.

Dr. Dennis K. Friesen completed his assignment with the Centro Internacional de Agricultura Tropical (CIAT) in Cali, Colombia, in September 1998, and has accepted a secondment to the Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT) in Nairobi, Kenya. He is serving as Regional Maize Systems Specialist for East Africa while on assignment to CIMMYT. He will provide research direction and planning to national program maize agronomists in countries forming part of the East African Cereals Project, which is funded by the Canadian International Development Agency (CIDA).

Mr. Ludwig G.F. Schatz joined IFDC in January 1999 as Director of the Human Resources Development Unit. He has 22 years' experience in the international agricultural development arena, having served in Kenya, India, Thailand, Viet Nam, Philippines, Indonesia, Myanmar, Bangladesh, Pakistan, and Afghanistan. His most recent assignment was with the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), GmbH, Germany, on a fertilizer extension project conducted in Kenya. 🌐

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International Fertilizer Development Center 1999 Training Calendar

Training Program/Study Tour	Dates	Location
1. Fertilizer Marketing Training Program	March 1-12	Mauritius
2. International Training Program on Computer Simulation for Crop Growth and Management Responses	May 17-28	U.S.A.
3. International Workshop on Current Environmental Issues of Fertilizer Production	June 7-9	Prague, Czech Republic
4. U.S. Study Tour: Advances in Agriculture Production and Fertilization	July 12-23	U.S.A.
5. International Training Program on Compound Fertilizer Production and Bulk Blending	August 9-20	U.S.A.
6. International Fertilizer Marketing Training Program	September 6 – October 1	U.S.A.
7. International Training Program on Integrated Plant Nutrient Management	October 18-29	Lomé, Togo
8. International Fertilizer Marketing Training Program	November 29 – December 10	Dubai

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