IFDC

Volume 13, No. 4
December 1988

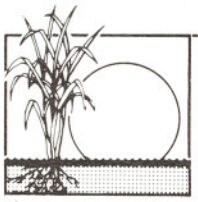
ISSN 0149-3434

Report

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

Headquarters—

New Soil Phosphorus Test Developed



A new soil testing technique to determine the amount of phosphorus in the soil that is available for plant use has been developed by IFDC. This new technique is simple, inexpensive, and accurate.

With funding from the United Nations Development Programme (UNDP), Dr. R. G. Menon, IFDC Soil Scientist, previously with the Food and Agriculture Organization of the United Nations (FAO), is collaborating on this on-going research. IFDC's work on this technique first began in 1984 during Menon's first sabbatical at IFDC as a visiting scientist.

The new test is an innovative approach to test soils for phosphorus. Instead of using the usual extracting solutions to dissolve phosphorus compounds in the soil, strips of paper coated with iron hydroxide are used as collectors for the phosphorus that enters the soil suspension. (When extracting solutions are used, they dissolve not only the phosphorus available for plant use but also some phosphorus that may not be available.)

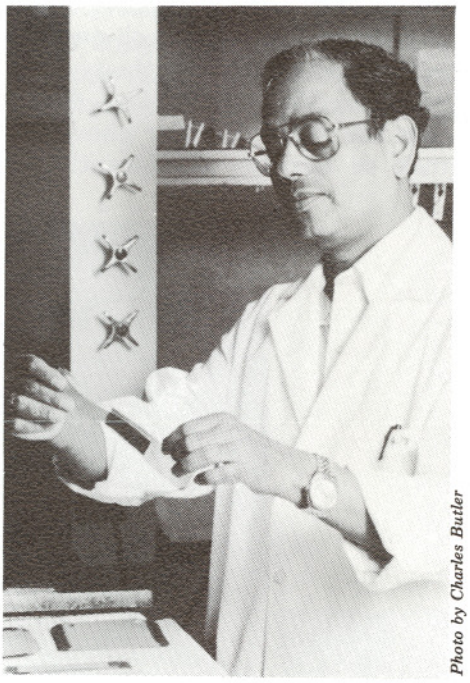


Photo by Charles Butler

Dr. R. G. Menon, IFDC Soil Scientist, performs the P_i test to determine the amount of phosphorus in a tropical soil.

When the strip of paper is placed in a soil-water suspension, the iron hydroxide on the strip adsorbs the phosphorus in the suspension and retains it. The strip is then taken out and the phosphorus retained is dissolved in dilute acid and measured. The idea of using iron hydroxide-coated paper to extract phosphorus was originally suggested by Dr. H. A. Sissingh, Retired, Institute of Soil Fertility, Haren, the Netherlands.

"Our research carried out thus far indicates that the phosphorus test has a good potential as a 'general soil test' for phosphorus," Menon says.

Unlike other phosphorus tests now being used, the new IFDC test shows potential to work well in all types of soil—acidic, alkaline, or calcareous, and appears especially suited for the phosphorus-deficient, acid soils of the tropics.

"Limited pot trials carried out at IFDC have shown that the test can be used in soils that have been fertilized with conventional fertilizers such as superphosphates as well as non-conventional materials such as phosphate rocks compacted with soluble fertilizers," he says. "The other tests can overestimate or underestimate plant-available phosphorus from soils treated with phosphate rocks or modified rocks."

The new methodology is inexpensive and the technology is appropriate to any laboratory in the less-developed countries. The paper strips can be prepared in any laboratory and the test itself is easy to perform. The papers are prepared by immersing hardened, ash-free filter paper in a 10% solution of ferric chloride in water. The papers are then dried and exposed to ammonia vapor to convert the ferric chloride into ferric hydroxide, and cut into strips 10 cm long and 2 cm wide.

To extract phosphorus from the soil, a 1-g soil sample is shaken with 40 ml 0.01 molar calcium chloride solution and one paper strip enclosed in a nylon net bag, overnight. The strip is then taken out, and the phosphorus sorbed on the surface is extracted by shaking with dilute sulfuric acid and measured.

IFDC is currently in the process of organizing field evaluations of the new technique. ■

In this issue...

Headquarters—

Peruvian Visiting Scientist Conducts Study of Bayovar (Peru) Phosphate Rock

When Ing. Angel Calvo, Visiting Scientist from the Universidad Nacional San Antonio de Abad del Cusco, Peru, returns to his native land at the end of 1988, he takes with him valuable information accumulated during a study of his country's Bayovar phosphate deposit. Ing. Calvo has been conducting his research during the past year at IFDC Headquarters, under sponsorship of the Organization of American States.

In many developing countries, the low level of phosphorus in the soil is one of the most limiting factors in crop production. Likewise, the high cost of conventional phosphate fertilizer, is another primary factor limiting its use. In developing countries this is often due to high manufacturing costs. For these reasons, an increasing number of countries in the world are considering the use of indigenous phosphate rock by finely grinding the rock and applying it as a straight phosphate fertilizer. Bayovar phosphate rock from Peru is among the most reactive phosphate rock sources for direct application in the world.

The development of the indigenous phosphate rock (Bayovar) deposit as a fertilizer is very important for the future of Peru's agriculture, increased food production, and and development of its economy.

Bayovar phosphate rock has been shown to be agronomically effective for direct application in acid soil because of its high reactivity. Less information is available, however, on the influence of crop species on the use of the Bayovar rock as a phosphate fertilizer. For this reason, during his stay at IFDC Calvo conducted greenhouse experiments to study the behavior of Bayovar phosphate rock as fertilizer.

The agronomic evaluation of Bayovar phosphate rock was compared with triple superphosphate for different crop species such as maize, wheat, rye grass, beans, and upland and flooded rice on two different types of soil—Mountview silt loam and Hartsells silt loam.

The soil samples were analyzed for available phosphorus by the Bray I method and the IFDC-developed Pi method. (See article on this method in this issue.)

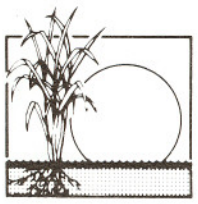
The good responses obtained in the experiments conducted by Calvo confirm that the agronomic effectiveness of Bayovar phosphate rock depends on the crop species and the types of soil used. The results show clearly that the use of Bayovar phosphate rock as fertilizer significantly increases the production of dry-matter yield. It confirms in general its agronomic effectiveness on different crops.

On Hartsells soil Bayovar phosphate rock was found to be as effective as triple superphosphate (TSP) for maize and kidney beans. On the Mountview soil, the same rock was less effective than TSP for maize, wheat, and flooded rice but as effective as TSP for upland rice and rye grass.

More work is needed under field conditions in Peru to verify the results obtained in the greenhouse study.■

Angel Calvo, Visiting Scientist, conducts laboratory tests of Bayovar phosphate rock.

Photo by Charles Butler



Headquarters—

Mexican Visiting Scientist Tests Family of Inhibitors

During the past year, a scientist visiting IFDC from the Universidad de Nuevo Leon, Monterrey, Mexico, Gildardo Carmona has produced significant findings in his work on improving the efficiency of nitrogen fertilization.

The overall goal of the Mexican professor's research work at Headquarters was to increase the efficiency of urea applied to the surface of upland soils. His specific objective was to evaluate the effectiveness of urease inhibitors in reducing nitrogen losses on these soils. The attention of Carmona's research was focused on winter wheat.

Urea is generally a good nitrogen fertilizer, but when broadcast on a moist soil it is subject to significant losses through ammonia volatilization after urea is hydrolyzed by the soil enzyme urease. Urease inhibitors can retard the hydrolysis of urea and thereby reduce volatilization by reducing ammonium levels and allowing rainfall to move the urea into the soil.

When urea is applied to winter wheat, it is typically topdressed in the spring; losses of nitrogen can be very high at that time. The results of Carmona's research have great potential for reducing these losses.

Professor Carmona conducted three primary experiments: (1) a study aimed at determining the effect of varying the amount of the inhibitor, (2) experiments to determine the effects of temperature on the effectiveness of the inhibitor to reduce nitrogen losses, and (3) a study designed to evaluate the effectiveness of different types of inhibitors.

The importance of Carmona's work lies in the fact that he has shown that even by using a miniscule amount of inhibitor (0.05%) ammonia volatilization can be reduced significantly; thus, money can be saved by using small amounts of the expensive inhibitor while still significantly reducing nitrogen losses. Carmona's work has shown that with an effective urease inhibitor nitrogen losses can be reduced from 60% (without the inhibitor) to 6%. In his greenhouse experiment grain yield of wheat was increased by 15% by using the inhibitor, N-butyl thiophosphoric triamide (NBTPT), at a concentration of 0.1% in urea on Savannah soil.

His work also revealed that a greater amount of inhibitor is needed at elevated temperatures and higher levels of organic matter content.

In summary, the inhibitor NBTPT was found to be effective in reducing ammonia volatilization losses in a soil with high urease activity. The efficiency of NBTPT rose when the inhibitor content in the urea increased from 0.01% to 0.10% and decreased as temperature was raised from 18° to 32°C. The other three inhibitors—N-butyl phosphoric triamide (NBPT), cyclohexyl thiophosphoric triamide (CHTPT), and cyclohexyl phosphoric triamide (CHPT)—compared favorably with NBTPT as urease inhibitors when used at both 0.10% and 0.01% concentration. ■

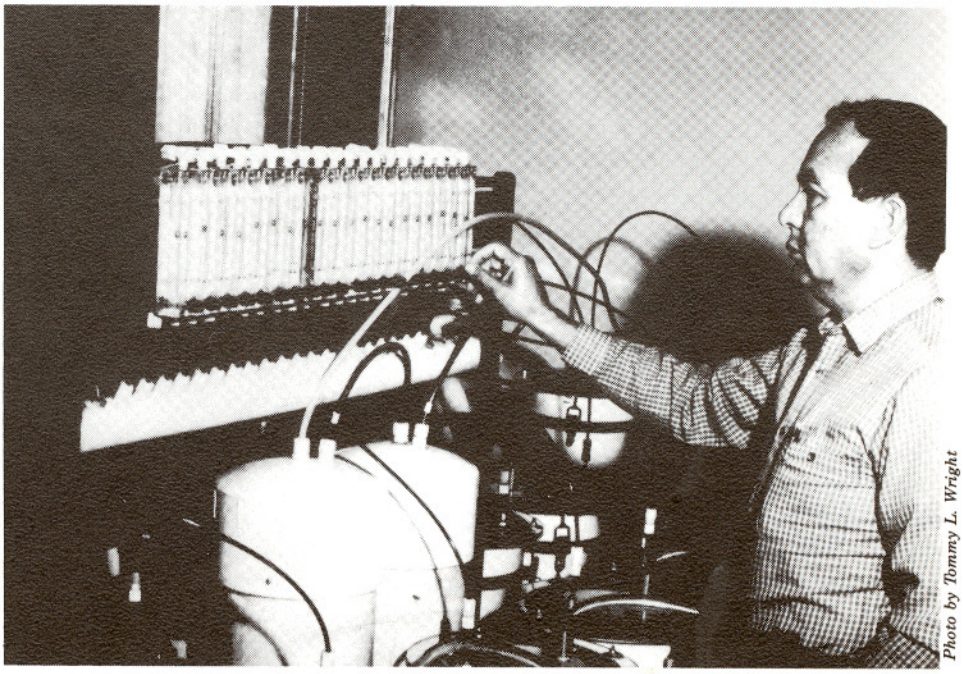
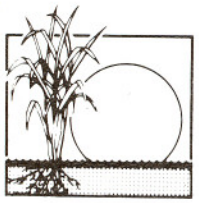


Photo by Tommy L. Wright

Gildardo Carmona, Visiting Scientist, uses a forced-draft system to measure ammonia volatilization and urea hydrolysis rate.



India—

IFDC Cosponsors Two Technical Meetings at ICRISAT

Colloquium on Soil Fertility and Fertilizer Management in Semi-Arid Tropical India

Sponsored by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the United Nations Development Programme (UNDP), and IFDC, a Colloquium on Soil Fertility and Fertilizer Management in Semi-Arid Tropical India was conducted at ICRISAT Center in Patancheru, India, during October 10-11, 1988.

The purpose and objectives of the colloquium were to collate knowledge on fertilizer use research in the semiarid tropics, to identify the principal impediments to fertilizer use and efficiency, and to set priorities for future research.

Eighty-seven participants from five countries, including Ethiopia, India, Somalia, Thailand, and the United States, attended the colloquium.

The IFDC representatives included Dr. L. L. Hammond, Director, Agro-Economic Division; Dr. P.L.G. Vlek, Director, IFDC-Africa; Dr. C. Bruce Christianson, Soil Scientist; Dr. Douglas C. Godwin, Agronomist/Systems Modeler; and Dr. Upendra Singh, Systems Analyst.

In addition to the excellent presentations by ICRISAT and Indian national scientists, IFDC's representatives contributed three papers. In his presentation on the "World Fertilizer Market Review and Outlook," Dr. Hammond pointed out the striking contrasts during the 1970s and 1980s. He stated that nitrogen, phosphate, and potash production capacity increased by 90%, 84%, and 24%, respectively, during the 1970s with much of the new capacity being located in the developing market economies and the centrally planned economies. In contrast, the 1980s has been a decade of instability. It is expected that during this decade nitrogen, phosphate, and potash capacity will increase by only 22%, 33%, and 17%, respectively, and again most of the new capacity built during the 1980s will be located in developing market economies and centrally planned economies.

In Dr. Vlek's presentation entitled "A Review of Soil Fertility Management in Semiarid Tropical Regions Other Than India," he focused primarily on soil fertility management in Africa with some reference to Latin America. Dr. Vlek pointed out that soils in Africa are generally chemically as well as physically very fragile and need judicious use of chemical fertilizers and crop residues to maintain their fertility in the absence of shifting cultivation system that historically has helped to restore soil fertility in this region. In Africa, phosphorus is the most important nutrient limiting crop productivity, but because of the low phosphate adsorption capacity of these soils, small amounts of phosphorus are enough to satisfy the crop phosphorus requirements. The native deposits of phosphate rocks in West Africa and Latin America offer advantage for use as phosphorus source either as such or certainly after partial acidulation.

Dr. Godwin presented a paper on simulation of nutrient dynamics in the cropping systems of the semiarid tropics. He discussed the CERES models for wheat, maize, barley, sorghum, and millet. The models consider water balance, nitrogen mode, phenology, photoperiod, vegetative phase, and grain growth period in predicting dry-matter production and crop yield. Godwin pointed out that the nitrogen model considers mineralization, immobilization, denitrification, leaching, nitrogen uptake, organic matter addition, and rate of its degradation as governed by various environmental and other factors. He also covered the application of these simulation models.

The proceedings of this colloquium is being prepared and will be published by IFDC by mid-1989.

Training Workshop on Sorghum and Pearl Millet Modeling

Following the colloquium, a training workshop on sorghum and pearl millet modeling was held during October 12-19, at the ICRISAT Center. The International Benchmark Sites Network for Agrotechnology Transfer (IBSNAT) joined the sponsors of the preceding colloquium as a sponsor of the modeling workshop. Fifteen agricultural scientists from outside ICRISAT, including one each from Thailand, Somalia, and Ethiopia, and about 19 ICRISAT staff attended the workshop.

Those from IFDC who assisted with the conduct of the workshop were Dr. Douglas C. Godwin, IFDC Agronomist/Systems Modeler, and Dr. Upendra Singh, Systems Analyst.

The objectives of the modeling workshop were to understand plant physiological processes to model growth of sorghum and pearl millet; to compare common principles of cereal crop growth models currently available; to discuss coupling of nitrogen subroutine in CERES crop models; and to review data base management systems.

The CERES Sorghum model was the focus of the training. Participants went through the complete cycle of entering sample experimental and soil characterization data, retrieving data, running the sorghum model and based on long-term simulation, determining risks associated with a given strategy. In addition, simulation exercises were conducted on the following: the effect of planting date—rabi versus kharif; irrigated versus rainfed crop; the effect of nitrogen fertilization—rate, splits, source; and the effect of different soil types on the above practices. ■

Headquarters—

Fertilizer Specialists Trained in Technical Management of Fertilizer Production Units

The success or failure in meeting desired fertilizer production goals can often be traced to the technical management methods used in the operation, maintenance, and engineering of fertilizer plants. Those facilities with expensive equipment and increasingly complex technology require highly coordinated and effective management to keep these plants operating efficiently and economically. Exposure of plant management personnel to the latest concepts of management and technology used in various production activities, together with a peer group drawn from many different developing-country situations, is one way to expand the overall plant production efficiency.

This concept was applied in a training program conducted by IFDC at Headquarters during October 24-November 11, 1988. The training program on the "Technical Management of Fertilizer Production Units" was attended by 25 fertilizer production personnel from 12 countries including Bahrain, Chile, Haiti, India, Indonesia, Jordan, the Philippines, Portugal, Qatar, Saudi Arabia, Venezuela, and Zimbabwe.

"The program covered a wide range of production management activities such as modern management techniques, plant maintenance and operation, advances in fertilizer process technologies, product quality control, safety, pollution control, and waste management," Nam Le, IFDC Chemical Engineer and the program's manager, says. "In addition, such topics as computer application in technical management and cost reduction through plant modification and improved management were addressed."

One of the program's participants, Ms. Hanan Al-Maskati, Process Engineer with the Gulf Petrochemical Industries Company of Bahrain for the past 6 1/2 years, found the experience to be very valuable. Ms. Al-Maskati's job is primarily concerned with production and consumption control. "I must determine how much ammonia my company is producing and the amount of raw materials and utilities the company is consuming and to ensure that these are economically used," she says. "My job also involves determining the feasibility of making modifications of the plant to correct specific problems."

Because her company is planning to begin producing urea in the future, Ms. Al-Maskati was especially interested in that technology. "I learned a great deal about urea, process technology, its problems, and solutions, which I can apply in the future."

In addition, she appreciated the opportunity to meet and discuss common problems with her peers in the field. "During the side discussions, I gained from others' experiences; I learned of their problems and how they are tackling them. Likewise the field trips to Baton Rouge and New Orleans, Louisiana (U.S.A.) gave me the opportunity to make contacts for future technical assistance."

A seasoned veteran of the fertilizer production business, Estelito L. Buenavista, Maintenance Engineer with the Atlas Fertilizer Corporation of the Philippines, gained a "more technical background in the production of various kinds of fertilizer." Buenavista, who has been with the same company for the past 30 years, is responsible for the maintenance of plant equipment and facilities, especially the programming of preventive maintenance.

His company is quite diversified since it produces various grades of NPK fertilizers and industrial chemicals, such as aluminum sulfate, dicalcium phosphate, tricalcium phosphate, and epsom salts. ■

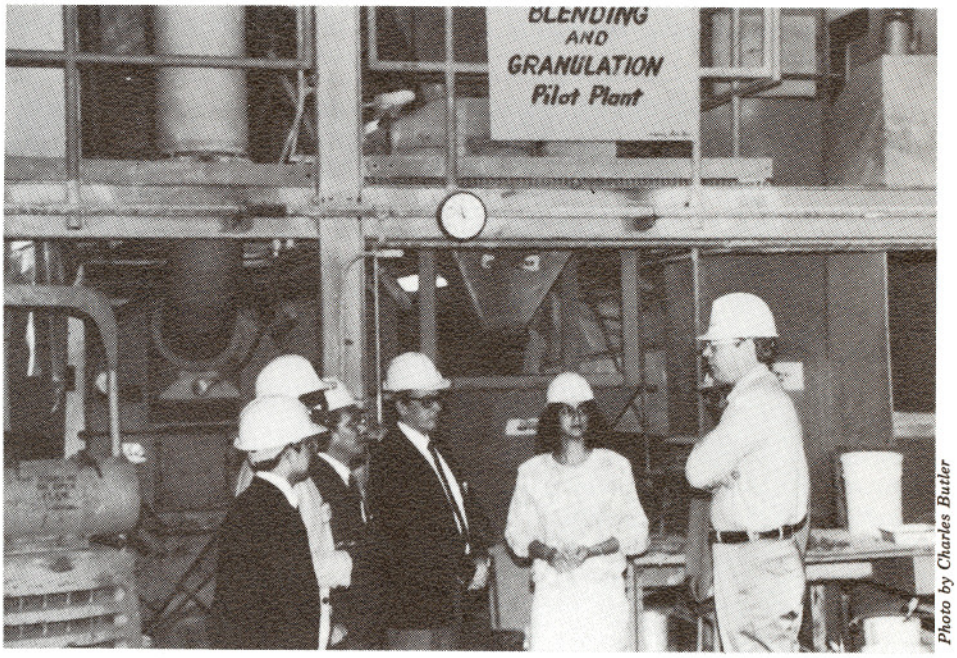


Photo by Charles Butler

George W. Bolds (right), IFDC Pilot-Plant Operations Coordinator, explains the operation of the blending and granulation pilot plant to the participants of the Training Program on the Technical Management of Fertilizer Production Units. Shown (from left) are Nam D. Le, IFDC Chemical Engineer and program manager; David Chigodore, Zimbabwe; Estelito L. Buenavista, Philippines; Luis Alberto Pereira de Araujo, Portugal; and Hanan Al-Maskati, Bahrain.

Headquarters—

Twelfth Version of Fertilizer Marketing Management Training Program Completed

Thirty-one participants from 14 countries attended the twelfth annual fertilizer marketing management training program during August 15-September 23, 1988. These middle- or senior-level managers, representing either government agencies or public, cooperative, and private fertilizer sectors, were from Brazil, Egypt, India, Indonesia, Kenya, Madagascar, Malaysia, Nigeria, Pakistan, Philippines, Saudi Arabia, Sri Lanka, United States, and Zimbabwe.

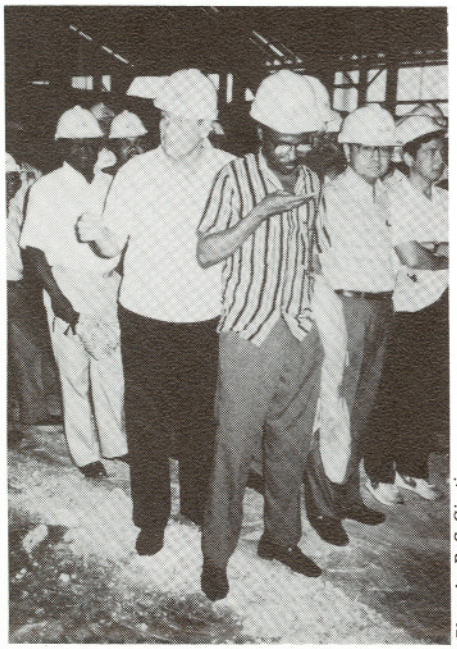


Photo by R. S. Giroti

Participants in the Fertilizer Marketing Management Training Program visit an IMC installation at Mulberry, Florida (U.S.A.). Here they are inspecting fertilizer materials in a bulk-blend plant.

According to the program's manager, Ian Gregory, IFDC Marketing Specialist, all aspects of fertilizer marketing and marketing management were covered during the program. Several approaches were used to present the curriculum: presentation of papers, the Alpha market simulation program, group activities in case studies, videos, and films. In addition, management communications were addressed with role play activities. Two half-day field visits were made to local farms, fertilizer dealers, and a fertilizer production facility.

The first one-week field trip included visits to Milan Research Station, Milan, Tennessee; University of Missouri, Columbia, Missouri; Farmland Industries; Kansas City Port; Rice Research Institute, Stuttgart, Arkansas; and Riceland Foods.

Photo by R. S. Giroti

FMMTP participants observe a farmer's operation in Missouri.

The second one-week field visit to Florida included visits to IMC phosphate mines, production facilities, and port facilities plus some farm visits.■

Headquarters—

Nigerian Officials Receive Special Training

Five officials from the Fertilizer Procurement and Distribution Division, Federal Ministry of Agriculture, Water Resources, and Rural Development, Government of Nigeria, participated in a special training program on "Fertilizer Distribution and Handling," which was conducted by IFDC during October 24-November 4, 1988.

The officials attending the program were B. Giwa, Agricultural Officer; A. C. Odukwe, Agricultural Officer; L. O. Ope, Higher Executive Officer; A. Oshoniyi, Agricultural Officer; and C. I. Ugwuonah, Senior Agricultural Officer.

According to the program's manager, Dr. W. E. Clayton, IFDC Transportation/Distribution Specialist, during the first week of the program, a lecture format was followed. A few of the topics covered included: "Characteristics of Efficient Distribution Systems," "Trends in World Fertilizer Consumption, Production, Trade, and Prices," "Cost Effective Fertilizer Supply Systems," "Market Research for Fertilizers," "Physical Properties Testing," "Quality Control Systems," "The Economic Analysis of Fertilizer Use," and "Fertilizer Supply Strategies for Nigeria."

During the second week, the participants received a more practical insight into fertilizer distribution and handling during field trips to IMC Florida; Tampa port; Florida State quality control laboratories in Tallahassee; and the port of New Orleans, Louisiana.■

Recent IFDC Publications

IFDC Annual Report, 1987

IFDC recently released its 1987 annual report, which focuses on the theme of "Drafting a Blueprint for Tomorrow," and contains a summary of the Ten-Year Plan that was formulated during 1987. This plan identified IFDC's priorities in the areas of research, technology transfer, and information dissemination.

The remainder of the publication follows a regional outline and covers the Center's activities in Africa, Asia, and Latin America. In addition, one section deals with our activities that are geared toward developing the human factor. The last section covers special global projects.

Complimentary copies of the annual report can be obtained by writing to the IFDC Purchasing Department, P.O. Box 2040, Muscle Shoals, Alabama 35662.

Agronomic Evaluation of Partially Acidulated Phosphate Rocks in the Tropics: IFDC's Experience

This publication, coauthored by Dr. S. H. Chien and Dr. L. L. Hammond, discusses the agronomic evaluation of partially acidulated phosphate rocks in certain tropical soils and crops. It also discusses important factors in the agronomic effectiveness of PAPR. These include (1) mineralogical composition and reactivity of phosphate rock used, and (2) soil properties and soil reactions.

To obtain a copy of this publication, please place your order with the IFDC Purchasing Department, P.O. Box 2040, Muscle Shoals, Alabama 35662. The cost of the publication is $4.00 for U.S. addresses and US $7.50 for non-U.S. addresses.

Photo by Charles Butler

Special Program on Fertilizer Distribution and Handling for Government of Nigeria Officials. From left, W. E. Clayton, Program Manager; L. O. Ope; B. Giwa; C. I. Ugwuonah; D. L. McCune, Managing Director; A. Oshoniyi; A. C. Odukwe.

1989 Calendar of Training Programs

Program	Location	Date
Fertilizer Marketing		
Fertilizer Marketing Training Program	Kingston, Jamaica	February 6-17
Data Collection, Analysis, and Projections for Fertilizer Sector Studies	IFDC Headquarters and other U.S. locations	April 3-21
Modern Trends in Fertilizer Distribution and Handling	United Kingdom, Ireland Netherlands, Belgium, West Germany	June 12-30
Fertilizer Marketing Management Training Program	IFDC Headquarters and other U.S. locations	August 14-September 22
Fertilizer Marketing Training Program	Singapore	December 4-15
Fertilizer Production and Technology		
Technical Management of Fertilizer Production Units	IFDC Headquarters and other U.S. locations	October 16-November 3
Relevant Fertilizer Supply Strategies (French and English)	Lomé, Togo	November 6-10
Fertilizer Use Efficiency		
Computer Simulation for Crop Growth and Fertilizer Responses	IFDC Headquarters	May 8-19
Statistical and Economic Analysis of Fertilizer Experimental Data (French and English)	Lomé, Togo	April 17-28
Fertilizer Sector		
Fertilizer Sector Development Training Program for Graduate Students	IFDC Headquarters	July 24-August 4
Finance for Non-Finance Managers in Fertilizer Sector	Singapore	November 20-December 1

Dates and locations are subject to change.

IFDC Report

Published Quarterly by the
International Fertilizer Development Center

IFDC is a public, nonprofit organization dedicated to increasing food production through the development of new and improved fertilizers and fertilizer know-how for developing countries.

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