

# Report

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



*Headquarters—*

## Century Club Sponsors Tenth Anniversary Celebration

"Then we were only three in number," reminisced Dr. John A. Hannah, the original and present Chairman of the IFDC Board of Directors.

Hannah was the featured speaker during the Tenth Anniversary Celebration, held at the Ramada Inn, in Sheffield, Alabama, September 25, 1985. The IFDC Century Club, a local support group, hosted the Tenth Anniversary dinner for staff members and spouses. Composed of leaders of the Muscle Shoals area and IFDC staff members, the Century Club provides a liaison between the Center and the surrounding area.

In his presentation, Hannah reviewed the accomplishments of the first decade and considered the goals for the forthcoming one. He carried the group back 11 years to a gathering of the original three Board of Directors—Lynn Seeber, then General Manager of the Tennessee Valley Authority; the late Webster Pendergrass, Vice President for Agriculture, University of Tennessee; and himself. The group formed an organization that they thought would do much toward "increasing food production and alleviating hunger in a world that many thought was either at or beyond the brink of disaster."

Hannah remembered the pessimists who believed that only so many coun-

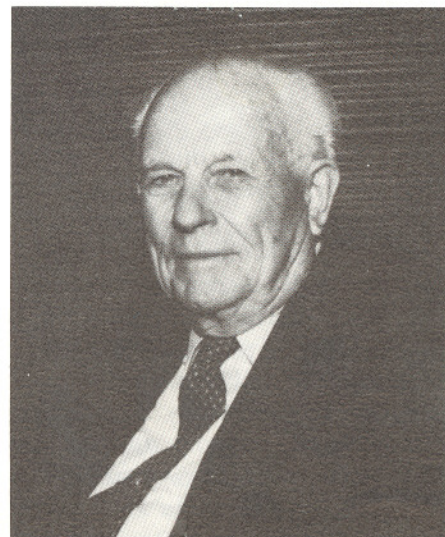
tries would survive and urged others to "do what you can and forget the rest."

"We heard of countries that were referred to as basket cases, which included India, Pakistan, Bangladesh, China, and others. . . Many of these countries have not perished and now stand proudly on their own feet. They recognized that agriculture had to be their solution and were brave enough to support agriculture at the expense of other things. In every case, the increased use of the right kinds and amounts of fertilizer played an important role. In many of these cases there is evidence that IFDC through its research, training, and technical assistance programs has helped these countries and many others to feed themselves and in some instances even to export large quantities of food."

But the world agricultural leader urged us not to stop here. "Some parts of the dream have become a reality," Hannah said. "But we have a whole new group of countries that are in deep trouble—Ethiopia, Sudan, Chad, Mali, Niger, and almost all of Africa."

"Our original dream must continue. We must have confidence that these countries too will recognize that their solutions will increase food production and improve nutrition. Fertilizers will play an extremely important role and IFDC must provide the leadership."

In concluding his speech, Hannah shifted his audience's thoughts forward to the future. "As we look back on the first decade, let us look forward to the end of the second decade when hopefully IFDC will be able to say the world's hungry countries and particularly Africa is recovering and that IFDC has played a significant role in helping the hungry nations of the world to stand on their own feet in looking forward to a peaceful and better fed world." ■



**Dr. John A. Hannah.**  
Chairman  
IFDC Board of Directors

## Technical Assistance Project Nears 8-Year Mark

*Editor's Note: On the occasion of IFDC's Tenth Anniversary, we are featuring two of its longest running projects—the Bangladesh project (below) and the IFDC/CIAT Phosphorus Project (pp. 4-5).*



The Bangladeshi farmer—  
What is his situation?

On his 1/4-hectare farm he manages to raise nearly enough rice and vegetables to feed himself and his family. His crops are subject to an erratic climate, which may bring periodic flooding or drought. Even in the best of times, life is hard in Bangladesh, having a per capita income of \$130.



A Bangladeshi farmer prepares to harvest rice.

Because it is one of the world's poorest and most densely populated countries, Bangladesh must constantly struggle to increase production domestically and make up shortfalls by importing from abroad enough food to feed its rapidly increasing population. But Bangladeshis are undeterred by their staggering problems; they exhibit an incredible optimism.

Although the Bangladesh people receive only the bare minimum of food, the country does possess substantial potential to increase its food production. Much of the country is blessed with an ample supply of water and potentially productive soils. In many

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areas of the country, certain crops can be harvested three times a year. At the present time, however, much of this potential is not realized because of excessive flooding caused by monsoonal rains. Provided proper management practices are adopted, the Bangladesh countryside can one day be covered with lush crops of rice, vegetables, and jute. Through better flood control and irrigation measures, more intensive use of fertilizers and high-yielding seed varieties, increased price incentives, and an improving system of rural credit, Bangladesh's labor-intensive agricultural sector has already achieved a marked increase in production. In 1984, for example, food grain production reached a record level of 15.3 million tons as compared to 10 million tons 10 years earlier.

Despite increased agricultural production, population pressures are such that Bangladesh continues to confront a chronic food deficit. One of the keys to increasing Bangladesh's food production is the availability and efficient use of fertilizer, which is the focus of one of IFDC's longest running projects.

With funding from the U.S. Agency for International Development (US-

AID), since 1979 IFDC has been assisting the Bangladesh Agricultural Development Corporation (BADC) in overcoming the fertilizer marketing and distribution constraints that impede the efficient use of fertilizer needed to raise food-grain production to self-sufficiency levels. This consultancy agreement is part of USAID's Bangladesh Fertilizer Distribution Improvement Project. BADC, a government-owned corporation, is responsible for procuring, marketing, and distributing most agricultural inputs, including fertilizers, to farmers.

According to Dr. E. C. Kapusta, coordinator of the Bangladesh project, a basic objective is to assist BADC in implementing the New Marketing System (NMS), which was established to overcome supply and demand constraints to fertilizer use. Under the NMS private independent dealers have assumed most of the responsibility for the distribution and retail marketing of fertilizer, which was formerly handled by BADC and cooperatives.

According to K. Z. Rahman, Fertilizer Project Assistant, USAID/Dhaka, the new marketing system has "introduced more privatization and



Bobby W. Biggers (left), Chemist, discusses the laboratory-scale fluidized-bed coating equipment with K. Z. Rahman, Fertilizer Project Assistant, USAID/Dhaka; A.T.M. Ahsanullah, Member Director—Supply, BADC; and Dr. E. C. Kapusta, Regional Coordinator—Asia.

improved the cost economy and availability of fertilizer to farmers." During 1984/85 BADC's fertilizer sales to dealers totaled 1,260,220 metric tons, compared with 465,100 metric tons 10 years earlier. The target for 1990 is 2 million tons.

As a further improvement, in late 1985 BADC established quantity discount centers or large wholesalers, lifting 40 or more tons. According to A.T.M. Ahsanullah, BADC Member-Director (Supply), "This system will enable BADC to minimize storage problems and reduce movement and handling costs."

IFDC's technical assistance project focuses on three main areas of activity—marketing, distribution, and dealer development and training. Each of these activities has been under the direction of a Dhaka-based resident consultant who worked with BADC management on a day-to-day basis.

"During the course of this project, the management and cost efficiency of the physical distribution of fertilizers have been improved," Kapusta said. "Distribution-related activities were focused on overcoming those constraints that limited fertilizer availability at the time and place it was needed by the farmer."

The distribution program has brought about economies in marketing and distribution costs. New movement contracts have been negotiated with truckers and shippers to lower transport and handling costs. A least-cost transport system was developed to ensure that primary distribution points (PDPs) were supplied by the most direct and lowest cost mode of transport available. The use of unit trains as a means of lowering distribution costs was also fostered. The development and implementation of a comprehensive stock control and accounting system helped to improve the operation of the supply planning and distribution system. An efficient warehouse management program—the key element in reducing losses and lowering handling costs—was developed and is being implemented.

Under the direction of the marketing consultant, a national monthly farmer survey was initiated in 1980. This survey gathers information on the

availability and prices of fertilizers paid by farmers; credit availability, use, and sources; sources and use of technical assistance; and paddy and wheat output prices. This information has been useful to policymakers in BADC and the Ministry of Agriculture in monitoring farmer prices under the new marketing system and in determining the impact of price decontrol on fertilizer prices in regulated and deregulated areas.

Through the dealer development and training component of the project, IFDC has assisted BADC in training its personnel and more than 16,000 private dealers in such areas as sales promotion and forecasting, inventory control, and product knowledge.

In addition to the three major project areas, short-term consultancies have been carried out on fertilizer distribution cost analysis; transport system analysis; procurement policy; byproduct gypsum use as a sulfur source; fertilizer price, availability and quality monitoring system; and the impact of price deregulation on fertilizer prices.

#### **Fertilizer Equity Study**

An extended 10-season farm-level fertilizer study was carried out in collaboration with the Bangladesh Agricultural Research Council (BARC) to gather information on (1) farm structures, credit, labor, and fertilizer and other input use and crop yields; (2) distribution of the benefits of fertilizer use by crops, seasons, and farm size; and (3) development of a model for estimating farm-level demand.

#### **Fertilizer Sector Policies**

This study developed fertilizer sector issues and recommended a set of coordinated fertilizer supply and use development policy options consistent with government agricultural development plans.

#### **Agronomic Research**

An IFDC/BARC Coordinated Fertilizer Efficiency program was initiated to determine the efficiency of urea deep-point placement as compared with conventional split broadcast applications on rice; to study the use efficiency of alternative sources of phosphate fertilizer; and to provide training in fertilizer efficiency research for personnel engaged in fertilizer research work. Information gathered from this research will expand the agronomic database and be helpful in establishing improved fertilizer recommendations.

#### **Training and Study Tours**

Since 1979 the technical assistance program has provided training for over 300 individuals from BADC, Bangladesh Chemical Industries Corporation (BCIC), BARC, and USAID/Bangladesh. These individuals have participated in training programs on fertilizer marketing, data collection and analysis, microcomputers, statistics and economics of fertilizer use, fertilizer production, distribution and handling, analysis of fertilizer equity study data, use efficiency research, and handling of bulk imports.

As a result of the advances made by BADC with contributions from the technical assistance project, the Bangladeshi farmer now can better rely on the availability of fertilizer when and where he needs it and information as to how he can use it to his best advantage in increasing crop production to meet national needs. "BADC has done a remarkable job in better serving the farmer's fertilizer needs," Kapusta says.

According to Ahsanullah, "The activities of IFDC have been extremely helpful to us; we are looking forward to a closer cooperation in the future." ■

## Ten-Year Project Impacting Colombia's Agricultural Sector



As a result of a project which was started in 1975, sales of fertilizers produced from two Colombian phosphate rock deposits have increased significantly during this decade from a negligible amount in 1976 to about 18,000 tons of ground phosphate rock in 1985.

Colombian farmers are now using the phosphate fertilizers produced from the Huila and Pesca deposits because they are effective and less expensive than imported phosphates. They have seen the results of the IFDC-assisted phosphate project in their country. They are learning that phosphate fertilizer can significantly increase the yields of their crops such as beans, rice, potatoes, groundnuts, and cassava.



A Colombian farmer, collaborating with the IFDC/CIAT Phosphate Project, cultivates land prior to planting.

In 1975 the Colombian Phosphate Project was started with the posting of Dr. L. L. Hammond, Soil Scientist, at the International Center for Tropical Agriculture (CIAT) in Cali, Colombia. At that time the research focused on the agronomic effectiveness of Colombian phosphate rocks for direct application and the mechanisms of phosphorus availability from directly applied phosphate rock. This early work by Hammond provided information on local phosphate rocks, which

was previously unknown, and served as the basis for funding of the IFDC/CIAT project by the International Development Research Centre (IDRC) of Canada in 1977. Three field experiments from the original work were carried over into the new project to study the residual value of seven phosphate rock sources on two soil classifications (Oxisols and Andepts) with forage grasses, cassava, and beans.

In 1977 with the initiation of IDRC funding, Dr. W. E. Fenster, Soil Scientist on leave from the University of Minnesota, and Dr. L. A. León, Soil Chemist, were stationed at CIAT. The project was expanded in scope both in terms of products and management practices. A shift toward modified products made from phosphate rock such as minigranulated phosphate rock, partially acidulated phosphate rock (PAPR) and cogranulated products was witnessed during this phase.

Also during this period, collaborative research was begun with such organizations as the Institute of Colombian Agriculture (ICA), the National Institute for Agricultural and Livestock Research (INIAP) in Ecuador, the National Institute for Agriculture and Livestock Research and Promotion (INIPA) and La Molina University in Peru, the Veterinarian Institute of Research in the Tropics and Highlands (IVITA), and the University of the East in Venezuela.

The focus of the phosphate research program at CIAT broadened in 1980 both in terms of geography and disciplines. Prior to this time, the majority of the agronomic research had been conducted on the acid, infertile soils of the Latin American lowlands (soils classified as Oxisols and Ultisols). In 1980 Hammond returned to CIAT for 2 years to replace Fenster and, with the aid of additional financial support provided by the United Nations Development Programme (UNDP), initiated expanded research with natural and modified phosphate materials in the volcanic ash-influenced soils (Andepts) of the Andean Highlands.

Socioeconomic research was also initiated in 1980 with the stationing of Dr. J. A. Ashby, Sociologist, at CIAT. Work in this discipline concentrated on identification of existing fertilizer management practiced by small farmers in the Andean region and determination of whether or not a change to products based on indigenous materials could be adopted by the farmers. This research was funded by the Rockefeller Foundation.

During this phase of the project, both on-station agronomic and socioeconomic results indicated that modified products such as PAPR showed higher potential than unacidulated phosphate rock for use in Andean cropping systems; the ground phosphate rock was less effective than when it was used in the acid Oxisols and Ultisols. Therefore, the focus of the project shifted once again during the period 1982-84 toward the validation of these results on farm-level trials conducted under the constraints typically encountered by farmers.

Beginning in 1982, León assumed leadership of the project. "Sixty experiments were established on Colombian farmers' fields," León says. "These experiments were established in three regions: (1) the high altitude tropical region, using potatoes, maize/bean association, and barley as the test crops, (2) the lowland region with rainfed rice, and (3) the mid-altitude tropics with beans and cassava. It was observed that the average yield of beans grown on 14 locations was increased from 362 kg/ha with no phosphorus to over 1,100 kg/ha with phosphorus, an increase of 300%. In these experiments, partially acidulated Huila phosphate rock was equally as effective as TSP at all rates of application."

During this period Ashby's work focused on interdisciplinary planning of on-farm research to identify the fertilizer technology components and management strategies appropriate to the circumstances of the small farmer in Colombia. Ashby developed innovative methods of involving farmers in the evaluation of alternative phosphate

fertilizers with cassava, bean, and potato crops and investigating constraints to phosphate rock use by farmers. This research has been integrally involved with that of soil scientists in the selection of collaborating farmers and the design, establishment, monitoring, and evaluation of on-farm trials.

Socioeconomic research in other agroclimatic zones was also facilitated by postdoctoral studies of Dr. E. Hansen and Dr. S. E. Guggenheim, sponsored by the Rockefeller Foundation.

Dr. C. A. Baanante, Economist, evaluated the benefit:cost relationships determined in the farm-level experiments and found that "in some soils of the Andean region and the eastern plains of Colombia, Huila ground phosphate rock and PAPR are economically competitive sources of phosphorus for potatoes, beans, maize/bean intercropping, cassava, and rice."

The newest phase of the project began in October 1984; this phase focuses on the soils of the Andean

Highlands—the area showing the lowest effectiveness from the direct application of phosphate rock alone.

"The objective of this phase is to find a means to achieve results similar to those observed with PAPR but using lower cost techniques," Hammond says. "The variables now being tested at the experiment-station level are: (1) the method of application of phosphate rock, (2) the time of application, (3) the use of phosphate rock in combination with soluble fertilizer, and (4) composting of phosphate rock with manures and other additives such as sulfur, ammonium sulfate, and urea."

Another feature of the new project is that the research has expanded outside Colombia, and collaborative agreements for supportive research have been reestablished with the following institutions: INIAP of Ecuador, INIPA of Peru, ICA of Colombia, the University of San Simone of Bolivia, the Ministry of Agriculture of Costa Rica, and the Graduate University of

Chapingo in Mexico.

In 1985 Dr. Adolfo Martinez, Economist, was stationed at CIAT to conduct studies on production economics and policy issues related to the phosphate project.

Although it was previously known that phosphate rock deposits were present in many Latin American countries, methods for utilizing them were unknown. The results of the past 10 years' research in the Phosphorus Project have shown that cheap and effective phosphate fertilizers can be made available to tropical farmers through the use of indigenous resources, thus making it possible for resource-poor farmers to purchase local fertilizers rather than the conventional and costly imports. Looking to other tropical regions, we see that spin-offs from this research have produced similar projects in Burkina Faso, Mali, Niger, Nigeria, and other countries in Africa; farmers in these areas stand a good chance of benefiting as well. ■

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#### Headquarters—

### "Tenth Anniversary" Open House Attracts Visitors From Several Countries

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Urea supergranules, urea-based NPK, urease inhibitors, and granular TSP were part of the "show and tell" offered to international visitors during IFDC's recent Open House.

Approximately 100 people from 14 different countries attended the Open House held at Headquarters during October 3-4, 1985. Conducted in conjunction with the 15th Technology Demonstration of the National Fertilizer Development Center (Tennessee Valley Authority), the Open House's purpose was to display the latest products and processes of fertilizer technology developed by the two Centers.

While touring IFDC's laboratories, greenhouses, and pilot plants, the visitors viewed displays portraying activities in technical assistance, including engineering assistance; marketing/sector studies conducted in Africa, Asia, and Latin America; and market research activities. They also learned about the Center's training activities in fertilizer marketing, produc-

tion, and use conducted at Headquarters and in the various regions of the developing world.

Moving to the fertilizer technology portion of the exposition, the visitors viewed displays and learned about urease inhibitors, urea supergranules, ureaforms, coating of urea, urea-based NPK fertilizers, and phosphate utilization. They heard chemists, engineers, and other staff members summarize results in these particular areas.

In the pilot plant, the attendees observed demonstrations on the production of granular triple superphosphate, sulfuric acid-based partially acidulated phosphate rock, NPK fertilizer by compaction, fluidized-bed coating of urea, and quality control of fertilizers.

Occupying a major portion of the show was the work in nitrogen research. "Our efforts to understand the magnitude and pathways of nitrogen loss from rice paddies have been successful," says Dr. Paul L.G. Vlek, Director, Agro-Economic Division. "Work in wind tunnels, growth cham-

bers, greenhouses, and recently in field studies has shown that ammonia volatilization is a major loss mechanism from flooded and puddled paddies under conditions of high pH and ammonium concentrations. By keeping the ammonia level low in the floodwater, ammonia volatilization can be minimized. Research has shown that ammonia levels in the floodwater can be kept low by deep placement of nitrogen or by using controlled-release nitrogen fertilizers to supply nitrogen at the time it is needed by the plants."

It was explained that deep placement can be accomplished in a number of ways. The most satisfactory and repeatable method has been to place large urea granules or briquettes about 10 cm into the soil. This has been done by hand, but efforts by the International Rice Research Institute, the Chinese, and others give hope that this operation can soon be mechanized to speed up adoption.

Supergranules (large granular particles or briquettes) have been made by

IFDC and others. With the growing interest in the use of these materials for deep placement throughout Southeast Asia, research efforts to produce large particles by Japan, the Netherlands, Norway, and the United States give promise that commercial processes will become available.

"The advantages of the briquetting process are: (1) it is less sensitive to the economy of scale; (2) it can use many feeds such as dusts, off-grade materials, crystals, or even prills; (3) it has a low energy requirement; and (4) its technology is simple," O. W. Livingston, Director, Fertilizer Technology Division, says. "Briquetting can be accomplished in small units in the village or as an adjunct to either prilled or granular production."

Coated nitrogen fertilizers have been shown to be very effective in increasing rice yields; they have produced results that are similar to those obtained with deep placement. The advantage of coated materials is that the farmer's practice does not have to be changed and fewer applications of nitrogen are needed. The disadvantage is the cost. Current approaches that were explained to the visitors included: (1) coating a substrate of larger particle size, which requires less coating per unit of weight, (2) seeking out areas where sulfur can have an economic value as a nutrient, (3) finding cheaper and more readily available indigenous coating materials, and (4) simplifying the coating process.

"Another promising approach is the use of urease inhibitors," Livingston says. "Inhibition of the urease enzyme decreases the rate of biochemical decomposition of urea to ammonia; this inhibition should decrease losses and increase the potential for uptake. Work in the laboratory and greenhouse indicates that concentrations of inhibitors as low as 0.5%-1.0% by weight in urea fertilizer can keep ammonia levels in floodwater low. It has not been proven, however, that this enhances nitrogen uptake to the degree necessary to make the use of inhibitors profitable."

Initial field tests have not shown the increased rice yields as anticipated. IFDC chemists are now beginning to understand the mechanisms of inhibition and are encouraged that improved

inhibitors can be synthesized.

Another major segment of the Open House focused on phosphate utilization. "Our phosphate program is strongly oriented toward assisting developing countries in the evaluation and development of their indigenous deposits," Livingston says. "Our work is also directed toward those deposits that are marginal in quality and not amenable for the production of phosphate fertilizers by the conventional processes."

The Open House visitors learned that each phosphate ore examined by the Center is characterized as to its potential routes for development, which will require minimal inputs of capital, energy, and other developmental costs. The potential uses of the phosphate ores usually are: (1) direct application, (2) modification through partial acidulation or thermal treatment, and (3) full acidulation leading to conventional phosphates, including the combination of other plant nutrients to make compound fertilizers.

Multinutrient fertilizer was another subject area that received major emphasis during the Open House. "As fertilizer use increases, especially in the developing countries, the trend will

likely be to use more multinutrient, granular fertilizers rather than single-nutrient materials," Livingston says. "Labor costs are reduced since several nutrients can be applied with one application, and simultaneous application of several nutrients has a positive effect on plant response to the fertilizer."

In the pilot plant the visitors observed the production of NPK fertilizers by compaction (a dry granulation process in which the mixed raw materials are agglomerated by pressure alone), and they heard explanations of other processes for producing solid compound fertilizers. They also observed the production of urea-based NPK fertilizers.

Finally, in the physical quality research laboratory, the visitors saw a demonstration of various tests conducted to determine the physical properties of various fertilizers. Demonstrations included tests to determine a fertilizer's caking tendency, hygroscopic properties, granule crushing strength, abrasion resistance, and impact resistance.

The visitors were allowed ample time to ask questions and discuss with staff members specific subjects that interested them. ■



Dr. Erick Peters (right), Chemist, discusses urease inhibitors with the IFDC Board of Directors during the recent Open House.

# Training Program Activities

**Headquarters—**

## **CARIBBEAN WORKSHOP OFFERS PROBLEM-SOLVING, AREA-SPECIFIC APPROACH**



"This workshop allows the fertilizer producers and marketers of the Caribbean Region a chance to air our common problems and try to address these problems with a view to having IFDC understand our problems and the fertilizer situation in the Caribbean."

These are the words of Gregory Shillingford, Manager of National Agro-Chemicals, Ltd., Trinidad, and a participant in the Caribbean Workshop on Fertilizer Technology and Marketing Systems held at Headquarters, November 11-15, 1985. Shillingford is a believer in IFDC's group programs; this was his third time to participate in the Center's programs. He had previously attended the Regional Fertilizer Granulation and Bulk-Blending Seminar (Bahamas, 1981) and the Fertilizer Marketing Management Training Program (Headquarters, 1982).

Sixteen participants from five countries, including Belize, Jamaica, St. Lucia, St. Vincent, and Trinidad, attended the Caribbean Workshop, which was directed by Dr. R. T. Smith, Training Specialist.

During Session I, entitled "The Farmer and the Land—Farming and Cropping Systems in the Caribbean," participants from Trinidad, Jamaica, and St. Vincent presented profiles of their countries' fertilizer sectors.

Various staff members made presentations during the other sessions relating to the dynamics of soil fertility; products and policy options; fertilizer research and extension programs; national policies and fertilizer marketing; and national policy, issues, and fertilizer use development. During the closing session the conclusions and recommendations of the workshop were discussed.

Since Shillingford attended previous IFDC training programs, he has put into practice some of the information and techniques that he learned. "I have used the marketing techniques, especially promotion and advertising," he said. "This training has been helpful to me in improving publicity and promotion campaigns, doing forecasting, and establish

ing demand for fertilizer."

"However, in the economies of the Caribbean, marketing forces do not always determine success of marketing," he said. "There are other factors that act as constraints to the application of training or seeing the benefits of training come to fruition."

As is the case with many other fertilizer companies today, Shillingford's company is finding it more difficult to compete. "Five years ago we were selling 7,000 tons of fertilizer; today we are selling only 1,000 tons," he said. "However, my company has been successful in one area; that is, we have been able to obtain exclusive distribution agreements to market urea in Trinidad and limestone produced by other government companies in Trinidad."

In closing, Shillingford expressed a hope for the future: "We would like to see, at the invitation of the different territories, more direct involvement of IFDC in the Caribbean." ■

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## **Recent IFDC Publications**

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### **Fertilizer Efficiency Research and Technology Transfer Workshop for Africa South of the Sahara, Proceedings**

This publication contains the keynote addresses and country papers from an international workshop held in Cameroon and cosponsored by the Institute of Agronomic Research, Ministry of Higher Education and Scientific Research, Republic of Cameroon. The central theme of the workshop was the efficient use of fertilizer; however, the workshop sessions also focused on the necessity and difficulty of combining fertilizer use with sound soil and water conservation practices and with organic matter recycling and the use, where possible, of legume crops and animal manures.

The main thrust of the workshop was to highlight the need for cost-effective use of fertilizers—the improvement of the agronomic and economic benefits to be derived from fertilizer use.

To order this publication (Special Publication SP-5), please send your request and US \$30 to the IFDC Purchasing Department, P.O. Box 2040, Muscle Shoals, Alabama 35662.

**Headquarters—**

## **SIXTH ANNUAL MAINTENANCE AND PRODUCTION MANAGEMENT PROGRAM TRAINS PLANT MANAGERS**



A 5-day workshop on the operations and maintenance problems of ammonia and urea plants was the highlight of the sixth annual Maintenance and Production Management Training Program.

This training program, conducted during September 30-October 18, 1985, consisted of two segments: the basic portion, which was conducted at Headquarters; and the more specialized 5-day workshop, which was held in New Orleans, Louisiana (U.S.A.). Twenty-seven participants from 10 countries attended the program.

"During the first segment of the program, specific questions were gathered from the participants; these questions were then grouped according to subject matter and teleaxed to the panel members prior to the workshop," said the program manager, M. T. Frederick. "During the workshop, the panel of fertilizer experts included these questions in their discussions and offered possible solutions to problems that the participants had encountered in the day-to-day operation and maintenance of their ammonia and urea plants."

The panel members included representatives from Toyo Engineering Company (Japan), Stamicarbon (The Netherlands), Norton Chemical Company (Houston, Texas, and Akron, Ohio [U.S.A.]), M. W. Kellogg (Houston, Texas), FERTIMEX (Mexico City), Agrico (Donaldsonville, Louisiana [U.S.A.]), James Chemical Engineering (Greenwich, Connecticut [U.S.A.]), Katalco (Houston, Texas), and International Technical Corporation (Baton Rouge, Louisiana [U.S.A.]).

In addition to participating in these activities, the group also toured the Industrial Technical Corporation (a nondestructive testing company) and VIP International (a catalyst-removal and cleaning company) in Baton Rouge, Louisiana.

The seventh annual program is planned for October 1986. Interested parties may contact the Director, IFDC Outreach Division, for further information. ■

# Upcoming Training Programs

Program	Location	Dates
<b>Headquarters</b>		
<i>Fertilizer Marketing</i>		
Fertilizer Sector Development in Tropical and Subtropical Agriculture	IFDC	June 16-July 25, 1986
Use of Microcomputers for Fertilizer Sector Personnel	IFDC	July 28-August 8, 1986
Fertilizer Marketing Management Training Program	IFDC	August 11-September 19, 1986
Quality Control of Fertilizer Products	IFDC	September 22-October 3, 1986
<i>Fertilizer Production and Technology</i>		
Fertilizer Process Economics Training Program	IFDC	June 2-20, 1986
Maintenance and Production Management Training Program	IFDC	October 13-31, 1986
<b>Regional Programs</b>		
Fertilizer Distribution and Handling Training Program	India, Indonesia, Malaysia, and Singapore	February 17-March 7, 1986
Statistics and Economics of Fertilizer Use (in Spanish)	Colombia	November 3-28, 1986
Fertilizer Marketing Training Program for Asia	Indonesia	December 8-19, 1986
Fertilizer Efficiency Research in the Tropics—Africa (in French)	West Africa	October 20-31, 1986

NOTE: Dates are subject to change.

For further information on these training programs, please contact the Director, IFDC Outreach Division.



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