IFDC

Vol.9—No. 2
June 1984

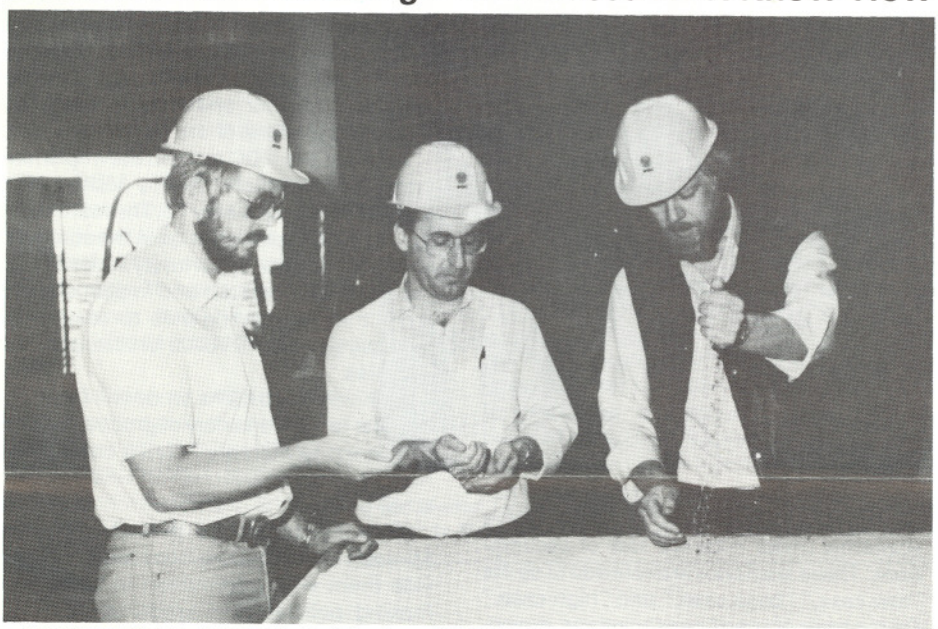
ISSN 0149-3434

Report

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

Headquarters—

IFDC and DSM Exchange Urea-Based NPK Know-How



Mr. Marcel Tanke, Special Project Engineer (left); Mr. Wim Cramer, Stamicarbon Engineer; and Mr. Theo Wolff, UKF Production Manager, inspect a sample of urea-based NPK fertilizer.

An idea exchange on urea-based NPK production between IFDC and DSM is proving to be mutually beneficial.

Two Dutchmen—Mr. Wim Cramer, Senior Commissioning Engineer, Stamicarbon, Geleen, the Netherlands, and Mr. Theo Wolff, Production Manager, UKF, Rotterdam, the Netherlands—visited IFDC Headquarters during April 16-May 10, to observe IFDC pilot-plant tests for the production of urea-based NPK fertilizer. In return, an IFDC engineer will soon visit their plant in the Netherlands to see similar operations on a larger scale (1,000 tons per day).

"The fertilizer world is a small world. All of us in the fertilizer business have to put our ideas together to create solutions for problems that we have in common."—Wolff

Stamicarbon, a subsidiary of DSM, has the responsibility for licensing, basic engineering, staff training, and commissioning of plants based on DSM know-how. UKF is the fertilizer division of DSM. UKF makes a very wide range of fertilizers, including single-nutrient nitrogen and phosphate fertilizers as well as various types of compound fertilizers. Its total annual production capacity is about 5 million tons of product. Much of this capacity is directed toward foreign markets including those in developing countries.

There is a worldwide interest in urea-based NPK production. Because of the high nutrient content in this type of fertilizer, the volume and weight are reduced, thus resulting in savings on transportation, storage, and application costs. In many developing countries, urea is readily available and is their most important nitrogen fertilizer material. The use of urea in the production of NPK fertilizers, however, causes process complications. To investigate and solve some of these problems, IFDC has started a pilot-plant research program.

(Continued on page 3.)

Headquarters—

Ugandan Rock Evaluated for SSP Production

An IFDC research team is helping Uganda find ways to use one of its indigenous resources. The researchers are testing Uganda phosphate rock's use in the production of single superphosphate.

In October 1982 the Bearden-Potter Corporation of Lakeland, Florida (consultants to the Ugandan Government), requested IFDC to determine the Ugandan rock's potential as a raw material in single superphosphate production from the beneficiated rock. Bearden-Potter, a private corporation, had been engaged by The World Bank to conduct a complete feasibility and engineering study for reinstating a single superphosphate plant that had been closed because of a civil war in 1978.

IFDC has completed characterization of the Uganda phosphate rock run-of-mine sample and a concentrate. The Center was requested to do batch single superphosphate production tests and to demonstrate the process in a continuous laboratory-scale unit. IFDC is arranging for testing of this product in Kenya (the potential market for this product) under the umbrella of the IFAD project.

Subsequently, the Ugandan Government expressed an interest in considering the partial acidulation and granulation of the concentrate. These tests have been completed, and results are being compared with single superphosphate.

As an extension of the study the Uganda Government requested that the rock be evaluated for production of phosphoric acid,

(Continued on page 3.)

In this issue . . .

Venezuela—

IFDC Team Develops 10-Year Marketing Plan

Venezuelan fertilizer factory worker resacks spilled fertilizer and handsews the bag.

An IFDC technical assistance project with the Venezuela company, Petroleos de Venezuela, S.A. (PDVSA), should help that country become self-sufficient in food production through an effective fertilizer marketing system.

At the request of PDVSA, a multidisciplinary IFDC team visited Venezuela during January 10-20, to analyze Venezuela's fertilizer marketing system and to develop recommendations that would help that country meet its fertilizer demand until 1993. The IFDC team consisted of Dr. E. C. Kapusta, Regional Coordinator—Asia; Dr. W. E. Clayton, Transportation/ Distribution Specialist; Mr. A. F. Little, Industrial Project Analyst; Dr. Adolfo Martinez, Agricultural Economist, and Mr. L. B. Williams, Regional Coordinator—Africa.

A previous IFDC study (1980) conducted for PDVSA primarily concerned fertilizer production and supply. The present study, however, is concerned with the marketing system and examines the probability of changing from granular fertilizer to blended fertilizer.

In projecting Venezuela's demands for fertilizer until 1993, the team developed three scenarios under different sets of assumptions. These scenarios are referred to as the "low case," "base case," and "high case." On the basis of specific assumptions, projections were made for the following variables: crop prices, nutrient prices, agricultural credit, crop areas, and irrigated areas. According to the "base case," demand for the primary nutrients is expected to increase steadily during the next 10 years.

The in-country data-gathering phase of the study was completed on January 20, and it was followed by a training phase at IFDC Headquarters. To assist IFDC team members and to afford PDVSA, PEQUIVEN, and PALMAVEN personnel an opportunity to learn more about various facets of study implementation and report preparation, PDVSA proposed providing three counterparts to work at IFDC with the study team. These counterparts included Mr. Canio Cestone, Chemical Engineer; Mr. Carlos Sánchez, Agronomist; and Mr. Luis Fracisco Rivero, Chemical Engineer.

Cestone, a member of PEQUIVEN's process evaluation department, worked with the team at IFDC for two periods, January 23-February 4 and February 27-March 26. His interest was related to the preparation of fertilizer demand projections. With Martinez' guidance, Cestone prepared a procedural manual for making and/or modifying demand projections based on models used in the study.

During the periods January 30-February 11 and February 27-March 15, Sanchez assisted Williams and Kapusta with the marketing portions of the study.

To assist the IFDC team in the implementation of the study, Rivero visited IFDC during February 27-May 26. The main objective of Rivero's participation in the study was to afford him the opportunity to learn how the study is structured and implemented in order that he may be able to assume an increasing role in PDVSA's fertilizer planning activities.

As Rivero sees it, the study will be of vital interest to a wide variety of groups. It will be of interest to not only PDVSA but also the Ministry of Agriculture, universities, and other groups.

"The report will be of interest to the Ministry of Agriculture because it will provide them with information to be used in making policies and assisting farmers," Rivero said. "From the study, universities will gain new ideas on fertilizer research and research that is needed to support the fertilizer industry."

On June 20 a meeting to review the study will be held at IFDC Headquarters. PDVSA and IFDC personnel will review the draft report and incorporate suggestions or ideas before the final report is completed. □

Headquarters—

Micronutrient Book Nears Completion

An IFDC state-of-the-art appraisal of micronutrient research in tropical agriculture is scheduled for publication in *Fertilizer Research* during late 1984. In addition, the publisher of the journal, Martinus Nijhoff/ Dr. Junk, will also be releasing the complete text as a separate volume at that time.

Dr. Paul L.G. Vlek, Director of IFDC's Agro-Economic Division, is the editor of the book, which contains ten chapters contributed by various international micronutrient specialists. Among the contributors are Dr. Willard L. Lindsay, Centennial Professor of Soil Fertility, Colorado State University; Dr. F. R. Cox, Professor of Soil Chemistry/ Micronutrients, North Carolina State University; Dr. J. S. Kanwar, Director of Research, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Hyderabad, India; Dr. John Moraghan, former IFDC Soil Scientist who was stationed at ICRISAT (now with North Dakota State University); and Dr. Mikko Sillanpää, Professor of Soils and Director, Institute of Soil Science, Finland.

The book evolved out of a study tour of 20 tropical countries, which Vlek conducted

It is hoped that the principles relating to micronutrients that are discussed will provide a background for Third World program scientists. . . .

(Con't on page 4)

NPK Know-How *(Con't from page 1)*

"We came to IFDC to get a more complete package of information on the process," Cramer said. "IFDC was a place where we could see the process from another angle. The emphasis during our visit is on the practical side of NPK production."

This information exchange is proving to be a very important and practical experience for both parties.

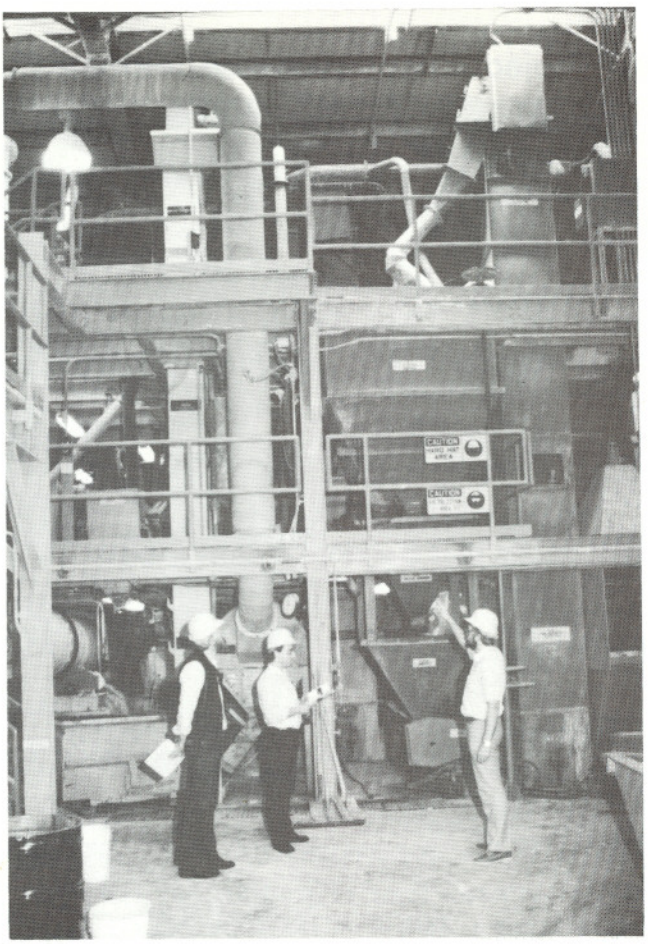
"The fertilizer world is a small world," Wolff said. "All of us in the fertilizer business have to put our ideas together to create solutions for problems that we have in common."

Each kind of fertilizer exhibits its own granulation behavior. Therefore, when a plant begins production of a new type of fertilizer, information is needed on its production characteristics.

The DSM personnel feel that their observation of the pilot-scale production at IFDC will smooth the way for the large-scale production at Rotterdam. This is especially important since they have only a limited period to do the large-scale tests.

They foresee an ongoing information exchange in the future between their company and IFDC.

"We look forward to enlarging our contact with IFDC in an intensive way," Cramer said.□



Mr. Marcel Tanke (right) explains details of IFDC's granulation pilot plant to Mr. Theo Wolff (extreme left) and Mr. Wim Cramer.

Ugandan Rock *(Continued from page 1)*

granular triple superphosphate, monoammonium phosphate, and diammonium phosphate. The purpose of these tests was to determine the behavior of the rock in these processes for a future expansion program.

Dr. A. H. Roy, IFDC Special Project Engineer, is handling the production studies for this project. In discussing the present status of the project, Roy said, "The plan at present is to set up a single superphosphate plant in Uganda. We will submit our final report to Bearden-Potter by the end of July 1984 so that Bearden-Potter can submit their report to The World Bank during the latter half of 1984. This report will then be used to attract private or public investors."

The IFDC researchers have completed the single superphosphate, and single-step partial acidulation/granulation tests in batch and continuous scale. As soon as they receive funding and concentrate from Uganda, they will perform the phosphoric acid, granular triple superphosphate, diammonium phosphate, and monoammonium phosphate tests.

The significance of this project lies in the fact that a potential market for this product exists in Uganda and neighboring countries that are presently importing single superphosphate. This product will provide a partial substitute for the imported product.□

People's Republic of China—

Fertilizer Research and Design Institutes Examined

As a member of a World Bank Mission to the People's Republic of China during March 5-24, Mr. Owen W. Livingston, Director of IFDC's Fertilizer Technology Division, visited five of the eight fertilizer research and design institutes established by the Ministry of Chemical Industry. The purpose of the mission was to evaluate the institutes and determine their need for a loan from the World Bank to provide new equipment and training.

Livingston accompanied three members of The World Bank's Industry Department and Dr. Bruce Stone, Economist with the International Food Policy Research Institute. The institutes on the itinerary included the Research Institute of Nanjing Chemical Industry, the Shanghai Research Institute of Chemical Industry, the Southwest Research Institute of Chemical Industry, the Design Institute of Nanjing Chemical Industry Company, and the Research Institute of Chemical Fertilizer Industry.

The Ministry of Chemical Industry established these research and design institutes to improve the fertilizer technology level of the country. Specific objectives of the institutes include: (1) developing schemes for using China's phosphate rock, (2) furthering the production of ammonia and finished fertilizers from China's indigenous coal supplies, and (3) improving the efficiency of China's small fertilizer plants.

"The Chinese recognize that these institutes need updating," Livingston said. "The instruments are old and lack automation. The personnel of the institutes need training."

To provide coordination for the eight research and design institutes, the Ministry of Chemical Industry created the China Fertilizer Development Center (CFDC) in January 1984. The purpose of the CFDC is to ensure that the work of the institutes is relevant to the needs of China. It is also charged with the responsibility of ensuring that duplication and overlapping are avoided and that people and equipment are used effectively and efficiently.

"Another purpose of my visit to China was to suggest new research areas that the institutes should undertake to solve China's fertilizer needs," Livingston said. "I was also asked to determine if serious problems of overlapping and duplication exist and how to minimize these in the future."

IFDC was also requested to comment on the planned training programs developed by the Chinese for CFDC and institute personnel. This may involve the training of Chinese scientists at IFDC Headquarters and other locations or sponsoring experts to travel to China to provide training.□

India—

Phase II of IFDC/ICRISAT Project Encompasses Additional Cropping Systems

Since 1980 IFDC and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) have collaborated on a fertilizer research project in India. The general objective of the project was to develop improved nitrogen fertilizer use technology for the semiarid tropics.

The semiarid tropics include almost 20 million square kilometers encompassing all or part of 50 countries in Africa, Asia, Australia, Central America, and South America. This region is harsh and is characterized by limited rainfall and nutrient-poor soils.

During Phase I (1980/81) Dr. John Moraghan, a former IFDC Soil Scientist, was stationed at ICRISAT. In that phase microplot techniques were established for studying the behavior of fertilizer nitrogen using tracer techniques under field conditions. Data were obtained for urea in sole sorghum crops on both red soil and deep black clay soil. Results revealed that for the best method of application (split banding) 50%-60% was recovered by the crop, 30%-40% remained in the soil, and approximately 10% was lost.

In April 1982 Dr. C. W. Hong, Soil Scientist, was outposted in India for the initiation of Phase II of the project. Hong recently discussed the progress of his work. "I wanted to broaden the database by comparing different nitrogen fertilizers," Hong said. "We have compared urea, diammonium phosphate, ammonium nitrate, ammonium nitrophosphate, and urea supergranules."

Since most farmers practice intercropping, Hong wanted to learn about nitrogen fertilization in different cropping systems. He first looked at the millet/groundnut cropping system and later added the sorghum/safflower cropping system.

Hong observed that there are extensive areas of shallow soils in the semiarid tropics.

Indian field workers mix soil prior to sampling for chemical analysis.

"In Korea 1 hectare of arable land will feed 17 people; in Japan, 23 people; but in India or Africa, only 3.5 people."
—Hong

During 1983 the trials were moved to shallow soils; he found that in shallow black soils the efficiency of fertilizer can be quite different from that achieved on deep black soils.

"My observation is that the important factor is rainfall," Hong said. "Many times people talk about the total amount of rainfall during the cropping system. We also found that the occurrence or timing of rainfall in relation to the application of fertilizer affects fertilizer efficiency."

To point out the importance of a project such as this, Hong made this comparison: "In Korea 1 hectare of arable land will feed 17 people; in Japan, 23 people; but in India or Africa, only 3.5 people. The combination of chemical fertilizer and the legume component must be strengthened for a long-term strategy."

The future direction of the project will be characterized by both a broadening and deepening of the database, covering different agroclimatic and soil conditions. Indepth observations within a location will seek to better identify the factors affecting the behavior and losses of fertilizer nitrogen. For example, the influence of factors—water, soils, nutrients, and cropping systems on the uptake of nitrogen by food crops—will be studied. □

Micronutrient Book *(Con't from page 2)*

during 1982/83 to assess their micronutrient problems.

"The book was an added bonus," Vlek said. "My original intention for conducting the study was to determine the extent to which IFDC should be involved in micronutrients."

The global tour during Vlek's assignment afforded him the opportunity of combining three activities: (1) observing tropical agriculture in different regional zones, (2) visiting different research institutions to determine their national research capability, and (3) determining the extent of knowledge on micronutrients existing in these countries.

The target audience of the book is national research program scientists in developing countries. It assumes that the reader already has a certain level of knowledge of micronutrients.

Vlek's book complements another publication by Dr. Sillanpää on micronutrients prepared for FAO. As comprehensive as his study is, Vlek emphasizes that the "picture" of the micronutrient situation is not complete.

However, it is hoped that the principles relating to micronutrients that are discussed will provide a background for Third World program scientists so that they can mirror their own accomplishments against those of other countries in the tropics. Thus, they should be better able to determine their own research needs.

And what are the implications of this study for IFDC's research program? Vlek foresees no immediate changes in the existing program. However, IFDC would like to develop a micronutrient program if funding becomes available.

"This is one area where IFDC fertilizer technologists can really make a mark," Vlek said. "Some micronutrient fertilizers that are currently available are inexpensive but not very efficient while others are efficient but very expensive. IFDC could make a strong contribution by developing a micronutrient fertilizer having both qualities—low cost and efficiency."

Vlek foresees that the book will have a continuing relevance for tropical agriculture. As he puts it, "There are indications that micronutrients will become a greater problem as crop intensification continues and farmers are being forced into less fertile lands." □

Philippines—

An IRRI Experience Draws to a Close

Philippine laborers transplant rice plots for a fertilizer applicator trial at IRRI.

After being posted at the International Rice Research Institute (IRRI) in the Philippines for 18 months, Dr. Ray B. Diamond, IFDC Coordinator of Fertilizer Evaluations, recently returned to Headquarters.

While at IRRI he worked with Dr. S. K. De Datta, Head of the Agronomy Department, and Dr. I.R.P. Fillery, IFDC resident scientist. His work with De Datta dealt with the conduct of trials to establish the effects of placement and timing of nitrogen on use efficiency in relation to soil nitrogen-supplying capacity and to investigate the efficiency of phosphorus sources and time and method of application in relation to soil characteristics. Laboratory studies were conducted to determine nitrogen release rates and phosphorus adsorption. His work with Fillery dealt with the identification of factors causing ammonia losses.

As is now commonly known, one of the major problems in irrigated rice is ammonia volatilization loss. Fillery is conducting quantitative measurements of these losses.

According to Diamond, any nitrogen field trials comparing sources or methods of application should include water sampling and analysis for fertilizer nitrogen. After arriving in the Philippines, he began trying to estimate the water depth and nitrogen concentrations to acquire a quantitative estimate of the amount of nitrogen in the floodwater.

Results of Diamond's work indicate that when urea is broadcast and incorporated with 4-5 cm of surface water, 45%-80% of the nitrogen applied appears in the floodwater, regardless of the rate of application. These results were derived both at the IRRI farm and at Maligaya Rice Research and Training Center and were based on depth measurements and the concentrations of urea and ammonium.

"When trying to incorporate urea into the soil while 4-5 cm of water is on the soil surface, most of the nitrogen is going to be in the floodwater," Diamond said. "If we can manage water, that is, if we spread the fertilizer onto a puddled soil that has little or no free water on the surface, mix with soil, and then add water 1-2 days later, I think that we may obtain greatly improved efficiency."

According to Diamond, any nitrogen field trials comparing sources or methods of application should include water sampling and analysis for fertilizer nitrogen.

Results of Diamond's work at IRRI indicate that late nitrogen applications must be applied earlier than 5-7 days before panicle initiation in order to obtain maximum yield. This was true even where soil nitrogen alone produced 5 tonnes per hectare of rice. The delayed application of nitrogen adversely affected yields on soils with lower nitrogen-supplying capacity more seriously than was the case with more fertile soils.

Another aspect of Diamond's field research included investigating the possible use of an ammonia quick test kit to determine if it can be used to determine ammonia levels in floodwater. Results of this research concluded that the kit can be used quite effectively if ammonia level is the only criteria that is being examined.

Diamond's work at IRRI included trials with not only nitrogen but also phosphorus. Partially acidulated phosphate rock (30% acidulation) performed equally as well as superphosphate but the lower levels of acidulation (15% and nil) were inferior for the crop immediately following application. It was found that phosphorus application may be delayed up to 4 weeks after transplanting without reducing yield response. □

Training Activities

Dr. Entol Soeparman, Director of Research and Development for P.T. PUSRI and an IFDC Board Member, addresses the participants in the Fertilizer Distribution and Handling Training Program.

India, Singapore, Indonesia—

Tri-Centered Program Conducted Second Time

Transport modes, port handling, bulk imports, packaging, and warehousing—these are a few of the topics covered during IFDC's second Fertilizer Distribution and Handling Training Program, February 20-March 9, in India, Singapore, and Indonesia. Cosponsors of the program were the Indonesian Association of Fertilizer Producers (APPI) and the Fertiliser Association of India (FAI).

Twenty-two senior- and middle-level managers in government or industrial organizations having responsibility for planning and/or operating fertilizer distribution systems attended the program. This year marked the first time that the program has attracted participants from Bhutan and Zimbabwe. Other countries sending participants included Bangladesh, Burma, India, Indonesia, Sri Lanka, and Thailand.

The manager of the program was Dr. W. E. Clayton, IFDC Transportation/Distribution Specialist. Other IFDC staff members were Mr. M. T. Frederick, Chemical Engineer, and Mr. R. S. Giroti, Associate Training Coordinator. Various experts from Indonesian and Indian companies and organizations made presentations.

This program concentrated on theoretical and practical aspects of physical distribution, packaging, handling, and warehousing. Formal presentations and discussions covered distribution theory while field travel, a major part of the program, provided the practical side of the program. The participants observed different activities and types of operations in India, Singapore, and Indonesia.

"At each location a different segment of the program was presented," Clayton said. "The distribution managers were exposed to a whole range of practices."

"In terms of learning, this program was a great experience for its participants. They learned innovative ideas to apply in their countries to make their distribution system an effective one." —Giroti

The participants of the Fertilizer Distribution and Handling Training Program listen to a lecture held in Madras, India.

"In terms of learning, this program was a great experience for its participants," Giroti said. "They learned innovative ideas to apply in their countries to make their distribution system an effective one."

On the first leg of their journey, the distribution managers visited India, which handles more fertilizer than any other developing country. In India they observed offloading, port facilities, warehouses, road, and rail handling facilities. The group learned about India's systems for handling bulk imports, which cover a whole range of methods from the fully manual to the fully mechanized.

"In Singapore, the crossroads of Southeast Asia, we saw modern bulk handling facilities and import bagging terminals at Jurong wharves," Clayton said.

On the last segment of their travels, the distribution specialists visited Indonesia. On the island of Sumatra, they visited P.T. PUSRI and learned about its sophisticated fertilizer distribution system, which covers all of Indonesia. Indonesia faces unique distribution problems since it must move fertilizer product between the islands. Most of the fertilizer in Indonesia is produced on Sumatra but consumed on Java and Sulawesi.

"At the PUSRI factory at Palembang, we observed storage and ship loading arrangements and saw a bulk ship being unloaded,"

(Con't on page 7)

Tri-Centered Program *(Con't from page 6)*
Clayton said. "Indonesia has modern self-discharging bulk fertilizer carriers that supply fertilizer to port bagging stations in Java, Sumatra, and Sulawesi."

On Java the group visited Petrokimia Gresik, a phosphate factory; P.T. Pupuk Kujang; and a port bagging station at Surabaya.

One of the participants, Mr. Sarvesh Chandra, General Manager (Marketing), Gujarat Narmada Valley Fertilisers Co., Ltd., Bharuch, Gujarat, India, has written words of praise concerning the program. "The field trips were very educational, and I saw many practices that I hope to implement," Chandra said.

The leaders of the 3-week program acknowledged the fine assistance they received from FAI and APPI.

Fertilizer producers and port authorities in the countries visited also gave excellent support to the program. Some of the organizations in India included: the Southern Petrochemicals Industries Corporation (SPIC), Madras Fertilizers Ltd., and Madras Port Authority. Others contributing to the program were Singapore Port Authority, as well as the Indonesian companies, P.T. PUSRI, Petrokimia Gresik, and P.T. Pupuk Kujang.

"Without the aid and facilities provided by these groups, we could not conduct this program," Clayton said. "We depend heavily on the generous cooperation of our friends in the fertilizer industry."□

Upcoming Training Programs

Program	Location	Dates
IFDC HEADQUARTERS		
Fertilizer Marketing		
Fertilizer Marketing Management Training Program	IFDC	August 13-September 21
Use of Microcomputers for Fertilizer Sector Personnel	IFDC	September 20-October 2
Statistics and Economics of Fertilizer Use	IFDC	October 2-19
Fertilizer Production and Technology		
Maintenance and Production Management Training Program (Highlighting Ammonia/Urea Plant Operations and Maintenance Problems)	IFDC	October 9-26
REGIONAL PROGRAMS		
Fertilizer Marketing		
Regional Fertilizer Marketing Training Program for the Asian Region	Thailand	November 26-December 8
Fertilizer Efficiency Research in the Tropics		
Fertilizer Efficiency Research in the Tropics—Africa (in French)	Mali	October 15-26

NOTE: Dates are subject to change.

Recent IFDC Publications

International Fertilizer Market Information Sources

Continuous monitoring and assessment of the international market conditions of key fertilizer products, raw materials, and intermediates are vitally important to the decisionmakers of fertilizer supply and marketing strategies in the developing countries.

To enable these countries to monitor and assess the international market conditions continuously, the decisionmakers need several types of information and must know where to locate such information. Furthermore, they must develop a mechanism for faster information access and must strengthen their information analysis capabilities.

This publication is an expanded and updated version of the publication issued in November 1980. It attempts to (1) identify the types of information that are considered essential for the decisionmakers and (2) highlight the published and unpublished information sources presently known to the author.

The information sources are discussed in four broad categories. The first category is the publications offered by commercial and noncommercial organizations for general public distribution. The second category is the computerized data services provided by commercial and noncommercial organizations on a subscription basis. The third category is the organizations with unpublished data files and reports that can be obtained on request. The fourth category is the international conferences and meetings regularly or occasionally held by commercial and noncommercial organizations. In this publication, a fairly comprehensive list of pertinent publications is presented. In addition, computerized data services are briefly described, and some examples of unpublished source organizations and international conferences and meetings are cited.

This publication, prepared by Dr. Yao H. Chuang, Market Development Economist, can be purchased by requesting IFDC Reference Manual-R-4. Please address your orders to the IFDC Purchasing Department. The only charge for the publication is a mailing and handling fee of US $4.00 for U.S. addresses and US $7.50 for overseas addresses.

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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