

India—

Regional Fertilizer Marketing Training Program

IFDC, in cosponsorship with The Fertiliser Association of India (FAI), conducted its first Regional Fertilizer Marketing Training Program in Bombay and New Delhi, November 17-December 3. The purpose of the program was to develop participants' knowledge of all those facets of fertilizer marketing that are required if the fertilizer marketing system is to operate efficiently.

Mr. Ram S. Giroti, IFDC Associate Training Coordinator, was the program manager. Twenty-two discussion leaders from India, FAO, and IFDC led discussions on world and regional fertilizer demand, supply, and technology and reviewed research on soils, crops, and fertilizer use that affect fertilizer consumption and fertilizer marketing systems in different countries of Asia. The program also covered such topics as crop insurance, distributors' and farmers' credit, composite input distribution centers, estimation of fertilizer demand, removal of constraints to fertilizer use, fertilizer policies, legislation, promotion, transportation, warehousing, handling, packaging, and marketing costs.

Thirty-one participants, representing 10 countries and 22 organizations, attended the program. Each participant has fertilizer marketing supervisory responsibilities with his organization or company. Seven participants each were from Bangladesh and Indonesia; six from India; three each from Sri Lanka and Thailand; and one each from Burma, Jordan, Malaysia, Pakistan, and Saudi Arabia.

Field trips formed an integral part of the program and provided a practical complement to the training sessions. In the Bombay area, the participants visited Trombay fertilizer complex of the Rashtriya Chemicals and Fertilizers, Ltd., granulation and superphosphate plants of Maharashtra Agro-Industries Development Corporation, and the port of Bombay where they saw fertilizer handling operations. The field trips around Delhi



Participants of the Regional Fertilizer Marketing Training Program: (Seated) Tin Tut, Anees K. Badr, N. H. Atthreya, Kazim R. Jafri, Rosita Batubara, Dennis H. Parish, Satya Nand, Ida Wahab, Gopal Sohbt, K. Z. Rahman, Ram S. Giroti (Standing—first row) S. K. Bhattacharya, Herman Mulyono, Permsak Rojanapainsati, Sadaeng Singhavara, Salzar Rahman, Md. Nazrul Islam, S. I. Seraji, Soegito Kasan, Achmad Mustari, S. Abid Hussain, H.P.G. Piyadasa, Md. Altaf Hossain, N. V. Sutjiatno, A. C. Govindan, Abdullah Ariffin, V. P. Goel (Standing—second row) J.M.J.C. Perera, Charles Seneviratne, R.R.S. Prasad, Yanyong Chootimun, A. A. Khan Chowdhury, A. R. Moerdowo, Md. Asadullah, A. K. Ranganathan, Marwan Khoury, John M. Hill, K. L. Suri.

consisted of visits to the Farmer Service Center of Indian Farmers Fertiliser Cooperative, Ltd. (IFFCO), the buffer storage facilities, and a retail distributor of Indian Explosives, Ltd., all located in Rohtak.

Participants also saw the farmers' field day organized by the Shriram Khad Program in the village of Badshahpur near New Delhi and the whole-farm and method demonstration of IFFCO in the village of Lali near Rohtak. The visits provided an opportunity for the participants to consult with marketing/promotional personnel of fertilizer companies, cooperative and government officials, dealers, and typical small farmers of Indian villages. Question-and-answer sessions involving the participants and the farmers showed the similarity of field problems in Asian countries.

Egypt—

Abu Tartur Phosphate Rock

At the request of the Egyptian General Executive Organization for the Industrial and Mining Complexes with headquarters at Cairo, IFDC carried out a 7-month program of bench-scale tests on the conversion of Abu Tartur matrix and concentrate into wet-process phosphoric acid. Greenhouse evaluation of both the matrix and the concentrate as a direct application fertilizer was also conducted. The project was completed in May 1980.

In cooperation with the Tennessee Valley Authority, IFDC determined the mineral and chemical compositions of the ores. The Abu Tartur matrix is a medium-grade ore (26.5% P_2O_5), containing gypsum, montmorillonite, and dolomite as the principal diluents. Acidulation of the matrix proceeded in three systems: the dihydrate, hemihydrate-dihydrate,

(continued page 2)

Due to the increasing cost of mailing publications, IFDC regrets that it must charge for reports and publications. A complete price list for IFDC reports and publications will be included in a future issue of the *IFDC Report*.

(from page 1)

and high-temperature dihydrate processes. Both the dihydrate and hemihydrate-dihydrate procedures gave good filtration rates, particularly once the rock had been finely ground, but overall P_2O_5 recovery was low because the gypsum cake was difficult to wash. The high-temperature dihydrate process was not so easily controllable as the others; consequently, P_2O_5 recovery in this process varied a great deal.

The Abu Tartur concentrate is a high-grade ore (32% P_2O_5) that is comparatively low in impurities. No problems were encountered in acidulation of the concentrate although corrosion rates on test specimens were higher than expected. The dihydrate process resulted in a good filtration rate and an overall P_2O_5 recovery of 93%; therefore, this ore is a good prospect for commercialization. Recovery and filtration can be expected to improve as experience is gained in processing the ore. The high-temperature dihydrate process showed some encouraging results, but the unsteady operation prevented significant conclusions. A potential problem with phosphoric acid made from Abu Tartur rock is the high level of Fe_2O_3 which could cause problems in subsequent fertilizer processes.

In the greenhouse tests, finely ground matrix and concentrate of Abu Tartur were found to be ineffective P sources on an excessively limed Crowley soil, but on an acid Mountview soil they were 39% and 49% as effective, respectively, as TSP for a single maize crop. A test of residual effectiveness showed the matrix and concentrate to be 52% and 61% as effective, respectively, as TSP on a second maize crop in the same soil. The presence of gypsum and free carbonate in the matrix may have reduced the solubility of its apatite and caused P_2O_5 in the concentrate to be greater. The Abu Tartur concentrate exhibited a medium to high potential for direct application to acid soils and appears to be satisfactory feed for phosphoric acid production. Acid quality is still uncertain.

IFDC Staff Update

Arrivals

Mr. Abdel Fattah Farag—Chemical Engineer—formerly of MANAH in Santos, Brazil—now with the Fertilizer Technology Division.

Departures

Mr. Bhaurao M. Bhujbal—International Atomic Energy Agency Fellow with the Fertilizer Technology Division—returning to the Bhabha Atomic Research Centre, Bombay, India.

Mr. Irwan T. Rusli—Chemical Engineer with the Fertilizer Technology Division—now with Occidental Research Corp. at Los Angeles, California.

Mr. Rolando Pacheco-Salazar—International Atomic Energy Agency Fellow with the Agro-Economic Division—now at the University of Florida in Gainesville, Florida.

Phosphate Research—

Kodjari Rock from Upper Volta

Upper Volta is a landlocked, developing country whose development of the agricultural sector has been limited in part by the excessive cost of soluble, imported fertilizers which in some cases can exceed \$1,000 per ton of P_2O_5 . It may be possible to minimize this problem by developing an indigenous phosphate deposit located near Kodjari.

In September 1979, the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Federal Republic of Germany, asked IFDC to determine the best method for utilizing Kodjari phosphate rock (PR) to produce agronomically effective phosphate fertilizer. This research was part of technical assistance provided the Government of Upper Volta by the Government of the Federal Republic of Germany. The project's objectives were (1) characterization of the rock to define feasible methods of phosphate fertilizer production; (2) recommendation of products for larger scale production; (3) development of technical data for a scale-up to pilot-plant testing; (4) production of selected products in laboratory scale to carry out soil-incubation and greenhouse tests on the products; and (5) provision of preliminary production economics on one or more processes and products selected for pilot-plant and field testing. The technical and agronomic studies indicate the need for further testing of Kodjari PR.

Kodjari PR is relatively unreactive and contains about 60% apatite (25.4% P_2O_5). High Fe_2O_3 and Al_2O_3 made the rock unsuitable for single superphosphate (SSP) production; the product was sticky and low in available P_2O_5 . Triple superphosphate (TSP) was not produced for testing. Partially acidulated products, using phosphoric acid at lower acidulation levels than those used to make TSP, were made in finely ground, minigranulated, and granulated forms. The available

P_2O_5 in the products increased with an increase in acidulation levels. The level of P_2O_5 water solubility decreased with an increase in granule size while the total availability (citrate plus water-soluble P_2O_5) remained constant. Phosphoric acid made in a clinker-type process contained up to 63% P_2O_5 ; however, 40% P_2O_5 acid was the maximum concentration obtained which did not precipitate a large amount of solids during storage for a few days at room temperature.

A greenhouse pot study showed that finely ground Kodjari PR was only 10%-15% as effective as commercial TSP in promoting growth of a single crop of maize. The most effective product was the finely ground phosphate fertilizer produced by 30% acidulation (with respect to TSP). This product was 89% as effective as TSP. The results of the soil-incubation studies showed that levels of soluble phosphate in soil increased with water solubility of the products. The addition of elemental sulfur did not enhance the dissolution of the Kodjari PR in the soil.

Preliminary production economics of a limited number of products showed that investment and production costs are directly proportional to the level of acidulation, with SSP at the highest and finely ground rock at the lowest. The economics of use (not including residual effects, transportation costs, and distribution costs) showed that the average increment in dry-matter yield per dollar cost of fertilizer product was the highest for powdered 30% partially acidulated Kodjari PR.

This project included the training of Mr. Martin Bikienga, a counterpart agronomist from Upper Volta, who participated in the preparation of the fertilizer materials tested in the laboratory and greenhouse.



Participants in the Kenya FERITT program are shown planting field plots.

Maintenance Management Training for Fertilizer Products

The first IFDC Maintenance Management Training Program for Fertilizer Producers was conducted at Headquarters, November 24-December 12.

The program objectives were to: (1) provide the participants with instruction in the theoretical and practical aspects of organizing and managing maintenance units for a variety of fertilizer production situations; (2) identify and relate the tasks of maintenance/planning to the realization of factory production goals; and (3) teach the basic techniques and methods used to plan, schedule, and implement maintenance tasks.

Mr. M. T. Frederick, IFDC Chemical Engineer, was the program comanager along with Mr. J. J. Schultz, IFDC Technical Training/Assistance Coordinator. The course material was presented by IFDC staff members—Mr. J. J. Schultz, Dr. Y. H. Chuang, Dr. R. T. Smith, and Mr. C. R. Amstrup—and by two management consultants—Dr. Lawrence Mann, Jr., Professor of Industrial Engineering, Louisiana State University, Baton Rouge, Louisiana, and Mr. J. M. Walsh, Senior Consultant, Management Systems, Mason & Hanger-Silas Mason Company, an engineering contractor and construction management firm located in Lexington, Kentucky.

The program covered such topics as “Developments in the World Fertilizer Colombia and Kenya—

Fertilizer Efficiency Research in the Tropics

IFDC recently conducted two training programs on fertilizer efficiency research in the tropics; one was held in Colombia and another in Kenya.

The first program was held in cooperation with the International Center of Tropical Agriculture (CIAT) at Cali, Colombia, September 15-October 4. This program was conducted in Spanish for 26 agronomists from 12 Latin American countries. Dr. R. T. Smith, IFDC Regional Coordinator for Latin America,



Participants in the Colombia FERITT program are shown harvesting replicated field plots.



Participants of the Maintenance Management Training Program for Fertilizer Producers: R. Alahuvel, Ibrahima Fahad Al-Makenzy, Fahad S. Al-Mutairan, Rigoberto Robles Cabrera, Miao Chi-Chin, Elio Comberlato, Mario Mattos de Castro, Luciano Bianchini Filho, M. Terry Frederick, Luis Ramon Centeno Gonzalez, Jose Ramon Lazo de la Vega Hoyos, Bernardo A. Jurado, David Usman Kazah, Elias Andraos Khammouni, Engkos Kostidjan, Ignacio Velarde Lopez, Roberto Palacios Merlano, Edgar Enrique Moncada, Leopold Radjaguguk, Omar E. Petit, Hadijan Rijanto, Md. Sadeque, Salamat Jhonatan Sidabutar, Abelardo Gonzalez Soler, Slamet Subagyo, Victor Manuel Thowinsson, Mohamad Tjahjo, Jose Pablo Perez Vazquez.

Sector,” “Impact of Plant Maintenance on Production Economics,” “Basic Management Principles,” “Measuring Maintenance Labor Utilization,” “Engineered Performance Standards,” “Organizing Maintenance Operations,” and “Maintenance Material Control.”

Twenty-seven participants, representing 10 countries and 16 organizations or companies, attended the program. Most participants are directly involved in the maintenance function in their respective organizations as maintenance managers, maintenance engineers, or planners.

was program manager for IFDC, and Eng. Carlos Flor was associate program manager for CIAT.

The other FERITT training program was held in cooperation with the International Institute of Tropical Agriculture (IITA) and the University of Nairobi in Nairobi, Kenya, November 24 through December 11. Thirty-five agronomists from 16 countries attended. Mr. L. B. Williams, IFDC Regional Coordinator for Africa, was program manager.

The 3-week FERITT programs were designed for agricultural research workers engaged in fertilizer efficiency research. Each program's goal was to help developing countries strengthen national field research programs that are directed toward improving the fertilizer practices followed by farmers. Emphasis was placed on ways of helping the small farmer to increase crop yields by using fertilizer more efficiently.

One-half of the time spent in the FERITT programs was devoted to class-

Participants visited either Agrico's Faustina facility in Donaldsonville, Louisiana, or International Minerals and Chemical Corporation (IMC) and AMAX Phosphates, Inc., in Central Florida. These field trips to commercial fertilizer production facilities provided participants with the opportunity to see maintenance management systems in operation and to have informal discussions with plant personnel. The field trips were tailored to each participant's major interest of nitrogen, phosphate, or compound fertilizer production.

room instruction and the other half to practical laboratory and field exercises. Procedures for conducting fertilizer trials with new or improved fertilizer materials; application techniques; and agronomic, economic, and statistical analysis of results were emphasized. Experiments were planted; replicated field plots were harvested and weighed; statistical analysis was made; and a report was written.

A highlight of the Nairobi FERITT program was the presentation of country reports on fertilizer use and research. The reports were prepared by the participants from each country and presented by their elected chairman.

The reports covered in detail the fertilizer used by products for principal crops in the participants' countries and the major constraints on fertilizer use. Research programs required to overcome the constraints were explored. Participants toured all of the ecological zones of Kenya where they studied the soil types and cropping systems of each zone.

PUBLICATIONS AND PAPERS AVAILABLE FROM IFDC

Publications and papers are available at no cost except that a shipping and handling charge is required—**Continental United States**, \$3.00 for first publication or paper, \$1.00 for each copy thereafter; **Other Countries**, \$5.00 for first publication or paper, \$2.00 for each copy thereafter.

IFDC Publications

- "Granular Urea—Advantages and Processes," T-1.
"The Potential for Regional Cooperation in Fertilizer—A Methodology Study of the ASEAN Group," T-2.
"West Africa Fertilizer Study (Volumes I-VII)."
Volume I—Regional Overview, T-3
Volume II—Senegal, T-4
Volume III—Mali, T-5
Volume IV—Upper Volta, T-6
Volume V—Niger, T-7
Volume VI—Chad, T-8
Volume VII—Mauritania, T-9
"Suggested Fertilizer-Related Policies for Governments & International Agencies," T-10.
"The Bangladesh Fertilizer Sector, 1978," T-11.
"Sulfur in the Tropics," T-12.
"World Fertilizer Situation and Outlook—1978-85," T-13.
"Organic Nitrogen Compounds for Use as Fertilizers," T-14.
"Bolivia Fertilizer Situation and Recommendations," T-15.
"Mexico: The Fertilizer Industry," T-16.
"Fertilizer Manual," R-1, Price—US \$15.00.
"Progress Report, 1976-1977."
"Annual Report 1978."
"Annual Report 1979."
"Seminar on Phosphate Rock for Direct Application," S-1.

Papers

- "Division S-4—Soil Fertility and Plant Nutrition," Hernan R. Tejeda, Chong W. Hong, and Paul L.G. Vlek, *Soil Science Society of America Journal*, Vol. 44, No. 6:1256-1262, November-December 1980.
"Dissolution of North Carolina Phosphate Rock in Acid Colombian Soils as Related to Soil Properties," S. H. Chien, L. A. Leon, and H. R. Tejeda, *Soil Science Society of America Journal*, Vol. 44, No. 6: 1267-1271, November-December 1980.
"Urease Activity and Inhibition in Flooded Soil Systems," P.L.G. Vlek, J. M. Stumpe, and B. H. Byrnes, *Fertilizer Research*, Vol. 1, No. 3:191-202, July-September 1980.
"Reactions of Partially Acidulated Phosphate Rock With Soils from the Tropics," U. Mokwunye and S. H. Chien, *Soil Science Society of America Journal*, Vol. 44, No. 3, May-June 1980.
"Recent Developments in Research on Nitrogen Fertilizers for Rice," E. T. Craswell and S. K. De Datta, IRRI Research Paper Series, No. 49, May 1980.
"Kinetics of Dissolution of Phosphate Rocks in Soils," S. H. Chien, W. R. Clayton, and G. H. McClellan, *Soil Science Society of America Journal*, Vol. 44, No. 2, March-April 1980.
"Application of Elovich Equation to the Kinetics of Phosphate Release and Sorption in Soils," S. H. Chien and W. R. Clayton, *Soil Science Society of America Journal*, Vol. 44, No. 2, March-April 1980.

"Phosphorus Availability from Partial Acidulation of Two Phosphate Rocks," L. L. Hammond, S. H. Chien, and J. R. Polo, *Fertilizer Research*, Vol. 1, No. 1, January-March 1980.

"Effect of Urea Placement on Leaching Losses of Nitrogen from Flooded Rice Soils," P.L.G. Vlek, B. H. Byrnes, and E. T. Craswell, *Plant and Soil*, Vol. 54, 441-449 (1980).

"Greenhouse Evaluation of Nitrogen Fertilizers for Rice," E. T. Craswell and P.L.G. Vlek, *Soil Science Society of America Journal*, Vol. 43, No. 6, November-December 1979.

"Transportation and Storage of Ammonia," Travis P. Hignett, to be published in the proceedings of the Fertilizer Industry Round Table, Washington, D.C., October 30-November 1, 1979.

"Technology of Production of Fertilizers Containing Ca, Mg, and S," Travis P. Hignett, to be published in the proceedings of the Colombian Soil Science Society, Colloquium on Saline Soils and Secondary Elements in Colombian Agriculture, Palmira, Colombia, September 19-21, 1979.

"An Analysis of N Nutrition on Yield and Yield Components for the Improvement of Rice Fertilization in Korea," P.L.G. Vlek, C. W. Hong, and L. J. Youngdahl, *Agronomy Journal*, Vol. 71, September-October 1979.

"Impact of a Training Program on Participant's Mastery of Fertilizer-Related Subject Matter: An Evaluation of a Fertilizer Marketing and Distribution Course," K. J. Byrnes, presented at the Annual Meeting of the Rural Sociological Society, Burlington, Vermont, August 24-25, 1979.

"Quality Factors of Phosphate Raw Materials," Guerry H. McClellan, Proceedings of the Fertilizer Raw Materials Resources Workshop, pp. 359-378, Honolulu, Hawaii, August 20-24, 1979.

"Dissolution of Phosphate Rock in Acid Soils as Influenced by Nitrogen and Potassium Fertilizers," S. H. Chien, *Soil Science*, Vol. 127, No. 6, 1979.

"Effect of Nitrogen Source and Management on Ammonia Volatilization Losses from Flooded Rice-Soil Systems," P.L.G. Vlek and E. T. Craswell, *Soil Science Society of America Journal*, Vol. 43, No. 2, March-April 1979.

"Possibilities for the Improvement of Nitrogen Fertilizer Efficiency and Rice Production," D. H. Parish, Proceedings of Division of Chemical Marketing and Economics of American Chemical Society Conference, pp. 99-115, Honolulu, Hawaii, April 2, 1979.

"A Comparison of Various Laboratory Methods for Predicting the Agronomic Potential of Phosphate Rocks for Direct Application," S. H. Chien and L. L. Hammond, *Soil Science Society of America Journal*, Vol. 42, No. 6, November-December 1978.

"Bench-Scale Studies of Utilization of Problem Rocks in Wet-Process Phosphoric Acid Production," A. Varsanyi, E. B. Winn, and P. H. Peng, Proceedings of ISMA Technical/Economic Conference, pp. 133-149, Orlando, Florida, October 23-27, 1978.

"Reactions of Phosphate Rocks, Rhenania Phosphate, and Superphosphate with an Acid Soil," S. H. Chien, *Soil Science Society of America Journal*, Vol. 42, No. 5, September-October 1978.



Published Quarterly by the
International Fertilizer Development Center

Barbara Holder
Communications Specialist
P.O. Box 2040

Muscle Shoals, AL 35660, U.S.A.
Phone No. (205) 381-6600

TWX-810-731-3970 IFDEC MCHL
JOHN A. HANNAH, Chairman
DONALD L. McCUNE, Managing Director
BOARD OF DIRECTORS—J. G. Crawford, Australia; Richard Freeman, U.S.A.; Ola Heide, Norway; David Hopper, Canada; S. K. Mukherjee, India; Eliseo Restrepo, Colombia; B. Shaib, Nigeria; Ibrahim F.I. Shihata, OPEC fund; Adolfo Sisto, Mexico; R. E. Wagner, U.S.A.; Miquel Zosa, Philippines.

PRINTED MATTER