IFDC

Report

Vol. 7—No. 1
March 1982

ISSN 0149-3434

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

Headquarters—

Plans for African Fertilizer Center Progressing

The morning sun filters through the eucalyptus trees overlooking a small farm in Chad in the heart of Africa. On his 2-hectare farm, Mohammed Sada ekes out a living for his family of nine by raising millet, sorghum, groundnuts, and a few animals. Lacking resources and knowledge of fertilizer, Mohammed—like many other African farmers—rarely uses chemical fertilizer. As a result, his yields are very low.

But a new day may be dawning for Mohammed and other African farmers like him—a new fertilizer research center for Africa is on the drawing board.

The Site Selection Committee for the proposed African Fertilizer Center met at IFDC January 18-22 and began the process of narrowing the possible locations. High on the list are: Cameroon, Kenya, Senegal, and Zimbabwe.

Members of the Site Selection Committee include two members of the Scientific, Technical, and Research Commission of the Organization of African Unity (OAU), headquartered in Nigeria: Dr. A. O. Williams, Executive Secretary, and Mr. A.H.A. Razik, Assistant Executive Secretary. Country representatives include Mr. Joseph K. Famolu, Central Agricultural Research Institute, Ministry of Agriculture, Liberia; Mr. Henri Rakotomanana, Ministere du Developpement Rural et de la Reforme Agraire, Service de la Production Vegetale, Madagascar; and Dr. Mohamed Alaa El-Din, Institute of Soils and Water Research, Agricultural Research Centre, Ministry of Agriculture, Egypt. IFDC representatives on the Committee are: Dr. Donald L. McCune, Managing Director, and Mr. Lewis B. Williams, African Coordinator.

The committee used criteria for selecting the host country that were established by the Inter-African Committee on Fertilizers at its first meeting in Cairo, June 1-4, 1981.

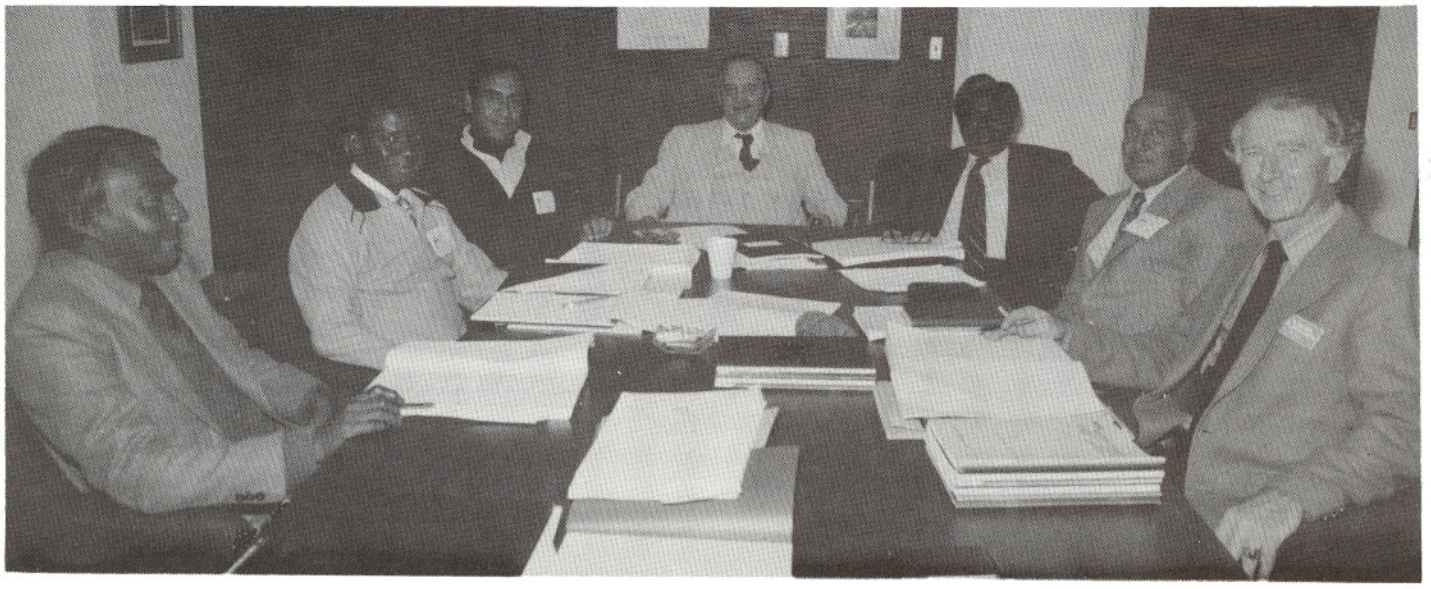
Two subcommittees of the Committee will visit the four above-mentioned countries to determine their desire and ability to host the Center. The Site Selection Committee will make its recommendations to OAU by May 15.

The long-range goal of the proposed African Fertilizer Center is to help make Africa self-sufficient in the production of food through the judicious use of the most appropriate fertilizer(s).

Dr. A. O. Williams commented on the Center's goal. "The correct application of suitable fertilizers, which implies that there should be an in-depth under-

An African farmer applies finely ground phosphate rock to his field. The proposed African Fertilizer Center will provide helpful information on fertilizer use for this farmer and others like him.

In this issue . . .



Members of the Site Selection Committee discuss the qualities of the countries being considered to host the African Fertilizer Center. They are (from left): Mr. Henri Rakotomanana, Mr. Joseph K. Famolu, Dr. Mohamed Alaa El-Din, Dr. Donald L. McCune, Dr. A. O. Williams, Mr. A.H.A. Razik, and Mr. L. B. Williams.

standing of soils and soil management in Africa, will be necessary to achieve this goal of self-sufficiency," he said.

Dr. Williams defined the potential benefits of the Center for the average African farmer. "The development of this Center will provide necessary information that should benefit the farmers. The research that will be carried out there will be more relevant to the needs of African soil; this will automatically help the farmer," he said.

In outlining IFDC's role in relation to the African Fertilizer Center, Dr. Williams said, "IFDC will be the foster parent of the Center; the foster parent will determine the quality of the offspring."

"There is no doubt in my mind that the experience of IFDC in different parts of the developing world places it at an advantage over many other organizations in ensuring that the African Center develops rapidly and functions efficiently. But like any other organization, the Center should be adequately funded to achieve its objectives, and funds should be used predominantly in Africa for the development of African agricultural programs," Dr. Williams said.

The scarcity of trained personnel is one of the main constraints to the development of emerging African nations. Dr. Williams recognized the role that IFDC will play in helping to train the necessary personnel.

"IFDC can help by training technicians in the areas of fertilizer production, marketing, and use," Dr. Williams said. "OAU is in a unique position to identify a suitable and adequate number of personnel in various countries to ensure that the Center is fully operational. Trainees will be selected from all African countries so that the expertise and knowledge from the Center will be disseminated throughout Africa."

Dr. Williams recognized the importance of linkages between other organizations and the African Fertilizer Center. "Even if the Center is highly Africanized, it should still maintain linkages with IFDC and other organizations with a view to keeping up with recent advances in research and their applications," he said.

When the African Fertilizer Center becomes a reality, farmers like Mohammed Sada will reap the benefits in terms of increased food production for their families. ■

Training Program Activities

Headquarters—

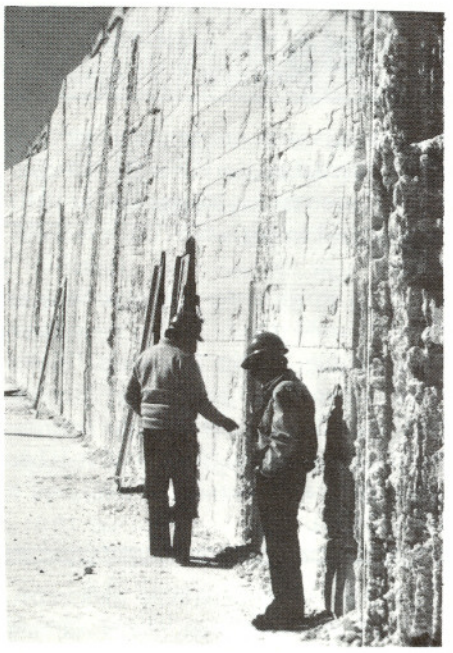
FERTIMEX Engineers Receive Practical Training

"It is a very beautiful challenge"—So has Mexico's President Jose Lopez Portillo described his homeland.

Part of this challenge has been accepted by the government-owned fertilizer industry, Fertilizantes Mexicanos (FERTIMEX) by striving to broaden their engineers' perspectives of the fertilizer industry. At the request of FERTIMEX, IFDC conducted a fertilizer production training program for 20 FERTIMEX engineers at Headquarters, November 9-December 11, 1981. The program, under the supervision of Mr. J. J. Schultz, IFDC Engineering Coordinator, was designed to provide technical and management training for the FERTIMEX engineers.

The core faculty was from IFDC; it was supplemented by representatives of the Tennessee Valley Authority (TVA) and expertise from fertilizer production and engineering companies.

That this program met its objectives is attested by two of the engineers,



FERTIMEX participants examine sulfur storage facilities at Freeport Sulphur in Port Sulphur, Louisiana.

Mr. Salvador Alvarez Rubio, Chief of Production, and Mr. Manuel Campos Ruvalcaba, Chemical Engineer, from the Guadalajara Unit of FERTIMEX.

The engineers learned of technology that is not being used in the Mexican fertilizer industry. "The most important technology that we learned concerns the production of complete fertilizers using the pipe reactor system (a simplified method for reacting phosphoric acid and ammonia)," Mr. Alvarez said.

"This system is good for making several formulas of complete fertilizer," Mr. Alvarez said. "We don't have this technology in Mexico; it would help us in improving the production of fertilizer."

In addition to learning about technology that is new to them, the engineers gained new insights that they can use in managing their plants. "We learned much about the management of fertilizer companies. When we go back to Mexico, we'll be able to better organize our departments," Mr. Campos said.

Besides attending lectures on fertilizer technology and production engineering, the engineers traveled to the U.S. Gulf Coast to observe the fertilizer industry. They observed maintenance and production management procedures in a nitrogen and ammonium phosphate production complex at the Agrico Chemical Company in Donaldsonville, Louisiana. They also visited an ammonia urea complex, CF Industries, Inc., in Donaldsonville. At Freeport Sulphur in Port Sulphur, Louisiana, they saw sulfur mining, storage, and handling operations. The engineers also observed bag manufacturing at the Chase Bag Company in New Orleans.

As a result of this training program, Mr. Alvarez, Mr. Campos, and the other engineers are better able to meet the challenges of their respective positions in FERTIMEX. ■

Nigeria—

Rain Forest Region Provides Setting for FERITT Program

Through a misty haze gently rolling hills dotted with palm trees are visible in a region where the tropical rain forest begins to blend with the savanna. Such was the setting in Ibadan, Nigeria, for a Fertilizer Efficiency Research in the Tropics Training (FERITT) Program. This program, sponsored by IFDC and hosted by the International Institute of Tropical Agriculture (IITA), was held on the IITA campus, November 2-20, 1981.

Scientists from IFDC and IITA formed the core faculty. Dr. R. B. Diamond, IFDC Coordinator—Fertilizer Evaluations, was the program coordinator. Other IFDC staff making presentations on the program were Mr. L. B. Williams, African Coordinator, Dr. H. R. Tejeda, Agronomist and Statistician, and Mr. P. M. Rosseau, Tropical Agronomist. Two IFDC sabbatical alumni were among the faculty: Dr. Johnson A. Ekpere, Lecturer, University of Ibadan; and Dr. Olu A. Osiname, Soil Scientist, University of Ife. Several IITA staff participated in the program; Dr. B. T. Kang coordinated the technical contribution while Dr. W. H. Reeves coordinated training support.

Twenty-seven participants from 13 African countries and one from Malaysia attended the training program designed for agricultural workers engaged in fertilizer efficiency research.

As part of the program, participants made presentations on their respective organizations' agricultural research programs. "The participants emphasized the effects their research programs have on agricultural production and the fertilizer industry," Mr. Williams said. "In the process they analyzed the programs and decided what improvements should be made."

The training program also afforded practical field experience for the participants. As in previous FERITT courses fertilizer trials had been preplanted so that the students could have the experience of harvesting the crop and analyzing the data.

"The students also designed experiments, laid out the plots, and planted them," Dr. Diamond said. "They divided into teams and reported on the activities and the statistical analysis of the data."

The program, which was presented in both English and French, ended on an interesting note. The participants selected one Anglophone and one Francophone spokesman for the group. Each spokesman appraised the program. ■

1981 FERITT participants harvest maize field trials.

Training Programs
Continued on p. 7

Nitrogen Research Expands

IFDC's initial effort in nitrogen research was aimed at lowland (flooded crops) and started in Asia with rice as the target crop because of the worldwide importance of rice as a crop and the population demands of the region. A collaborative research effort was established between IFDC and the International Rice Research Institute (IRRI). Since 1978 an IFDC scientist has been posted at IRRI in Los Banos, the Philippines. The research goal is to improve the efficiency of nitrogen fertilizers applied to rice, which often recovers no more than 30% of the nitrogen applied.

In 1979 the upland phase of the nitrogen program was initiated. This program includes major crops grown under upland conditions in specific agroclimatic zones. The zones of interest were the semiarid tropics, the arid regions, and humid tropics. Within these three regions, IFDC now has collaborative projects underway with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the International Center for Agricultural Research in the Dry Areas (ICARDA), and International Institute of Tropical Agriculture (IITA). The United Nations Development Program (UNDP) is funding the ICRISAT and ICARDA projects; the International Fund for Agricultural Development (IFAD) is funding a project at the ICRISAT substation in Niamey, Niger, and at IITA.

Recent developments include a project in Indonesia funded by the Australian Development Assistance Bureau (ADAB) and a project at the Onne station of IITA sponsored by the Dutch agency for international collaboration (DGIS).

Syria—

Nitrogen Uptake Proves Dependent on Soil Moisture

Research conducted under a cooperative agreement initiated in April 1980 between ICARDA and IFDC has shown that the uptake of nitrogen fertilizer by crops is strongly dependent upon stored soil moisture and rainfall.

In the ICARDA mandate region (including north Africa and West Asia), fertilizer use on rainfed crops is small. Farmers with irrigation or ensured adequate rainfall do use fertilizer. Fertilizer use by farmers in dry areas is small, partially because they think the response to fertilizer is not large enough. In addition, they may not fully understand how effective fertilizers are.

With the need for increased food production and the introduction of new fertilizer-responsive crop varieties, a better understanding of the role and efficiency of fertilizers in dryland farming is required.

The purpose of the IFDC/ICARDA agreement is to conduct research on the efficiency of fertilizer use in dryland farming and the cycling and availability of nitrogen in soils of the ICARDA mandate region. This region has a rapidly increasing population and a growing food deficit.

The two centers agreed to share information, expertise, and knowledge relating to fertilizers, to coordinate efforts to strengthen the respective programs of the two centers, and to minimize duplication of effort. Dr. Karl Harmsen, Soil Chemist, is the collaborator at ICARDA; his IFDC counterparts are Dr. P.L.G. Vlek and Dr. R. J. Buresh, Soil Scientists.

In his research conducted on wheat and barley, Dr. Harmsen has tested materials produced by IFDC's Fertilizer Technology Division. These products are ammonium nitrate, urea, and modified urea products. He has found that nitrogen uptake by wheat and barley depends strongly on stored soil moisture and rainfall.

One of Dr. Harmsen's laboratory assistants, Ms. Jemma Maksoud, is presently at IFDC for a 3-month training period. She is learning more about analyzing soil and plants to determine their nitrogen content. In addition, she is learning to use new types of laboratory equipment.

Ms. Maksoud's training at IFDC will have a ripple effect once she returns to ICARDA. "When I return to ICARDA, I will be able to conduct additional types of analyses that I have not done thus far," Ms. Maksoud said.

Ms. Maksoud's homeland has a diverse range of agricultural crops since it has both irrigated and rainfed agriculture.

"The crops range from wheat, cotton, and vegetables to oranges and olives," she said.

The researchers at ICARDA are looking for ways to combat the problems faced by farmers of the dryland regions of west Asia and north Africa. ■

Dr. Karl Harmsen (left), ICARDA Soil Chemist, and an assistant take a soil sample for ICARDA/IFDC collaborative project.

Philippines—

IFDC/IRRI Research Aids Tailoring of Fertilizers

Research being conducted at IRRI on lowland rice by IFDC/IRRI scientists is providing information that Headquarters' engineers can use in tailoring fertilizers.

This knowledge is acquired in two ways: (1) by gaining basic information about the causes of the poor efficiency of nitrogen fertilizer applied to rice and (2) by evaluating under field conditions at IRRI the improved fertilizer materials that prove promising in greenhouse tests.

Dr. I.R.P. Fillery, IFDC Soil Scientist, has been posted at IRRI since January 1980. Dr. Fillery has been working with Dr. S. K. De Datta, Agronomist and Head of IRRI's Department of Agronomy, and more recently, Dr. J. R. Simpson, Senior Principal Research Scientist, Commonwealth Scientific and Industrial Research Organization (CSIRO).

"The main objective of our research has been to measure the losses of broadcast urea through ammonia volatilization under natural field conditions using a sophisticated micrometeorological method developed by CSIRO," Dr. Fillery said. Dr. Fillery's recent fieldwork in the Philippines has confirmed work done at IFDC Headquarters that suggests that up to 50% of broadcast urea can be lost to the atmosphere as ammonia. This result has provided special impetus to IFDC's Headquarters' program to develop effective urease inhibitors, which reduce the rate of urea hydrolysis, limit ammonia concentrations in the floodwater and thereby reduce ammonia losses.

Dr. Fillery has just begun his first field experiment using urease inhibitors supplied by IFDC's Technology Division to improve the efficiency of urea applied to rice. IFDC Headquarters' work shows that under controlled conditions urease inhibitors can reduce nitrogen volatilization losses of broadcast, topdressed urea.

"Since much of the rice grown in Asia is rainfed we have also begun research using ^{15}N to determine the magnitude of losses of nitrogen applied under conditions of poor water control as part of a major reorientation of our program away from irrigated rice," Dr. Fillery said.

IFDC, jointly with IRRI, has also been evaluating a wide range of modified ureas, including silicate-polymer-coated urea prepared by the Korea Advanced Institute of Science and Technology (KAIST) and IFDC. "Silicate-polymer- coated urea has proven to be a very effective fertilizer for rice. Further work is required to determine the technical and economic viability," Dr. Fillery said.

IFDC outposted scientists are providing valuable information to help direct the work of Headquarters' staff who are involved in the development of fertilizer products. ■

India—

ICRISAT Research Seeking Ways to Reduce Nitrogen Losses

An IFDC researcher posted at ICRISAT is working with ICRISAT scientists on ways to reduce nitrogen losses and improve the effectiveness of nitrogen fertilizers.

In the semiarid region of India (the setting for ICRISAT), fertilizer use is low. Available fertilizer is usually used on rice or irrigated crops. The areas of dryland farming get the lowest priority for fertilizer. Therefore, there is a need for more research on the response and fate of fertilizer in this region.

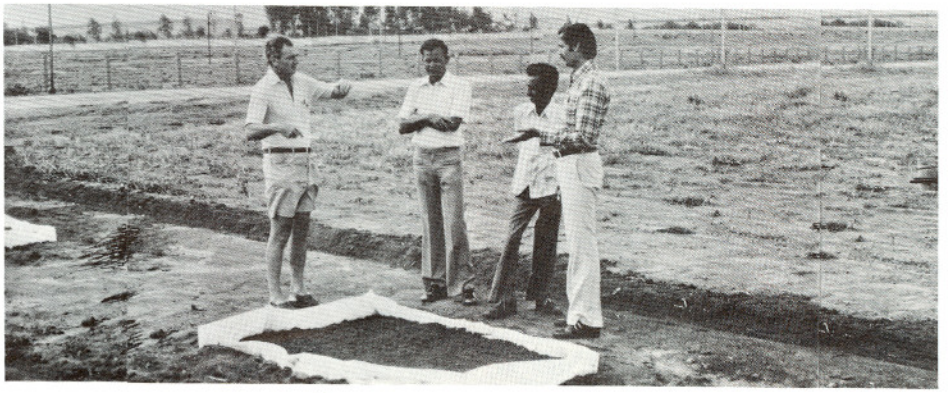
The IFDC/ICRISAT collaborative project, which began with a grant from UNDP in 1979, focuses on solving some of these problems. Since May 1980 Dr. John Moraghan, IFDC Soil Scientist, has been posted at ICRISAT. Dr. P.L.G. Vlek and Dr. R. J. Buresh, Soil Scientists, serve as IFDC coordinators of the project.

The objectives of this research are (1) to determine the fate of nitrogen fertilizer in the soils of this region, (2) to determine factors affecting the uptake of nitrogen fertilizer by crops, and (3) to improve the utilization of nitrogen fertilizer by crops in the region through changes in application method and modification of the fertilizer.

In his research Dr. Moraghan has been measuring the response of sorghum to nitrogen fertilizer, evaluating the losses of nitrogen fertilizer, and comparing different fertilizer sources and placement methods.

"IFDC's Fertilizer Technology Division prepared the materials that Dr. Moraghan has been testing," Dr. Buresh said. "The principal materials are urea in various granule sizes and modified urea fertilizer (containing additives)."

Findings that have resulted from this research conducted at ICRISAT are: (1) nitrogen is a constraint to crop production in semiarid regions; (2) placement of urea below the soil surface can markedly reduce loss and increase its effectiveness as a fertilizer; and (3) gaseous loss of ammonia from broadcast urea is small in comparison with that for flooded rice. ■



Dr. John Moraghan (left), IFDC Soil Scientist outposted to ICRISAT, describes microplots to ICRISAT personnel prior to planting of sorghum.

Africa—

IFAD Project Focuses on Phosphorus and Nitrogen

Two locations—the ICRISAT Sahelien Centre in Niamey, Niger, and IITA in Ibadan, Nigeria—are the initial sites of a project focusing on phosphate and nitrogen fertilizer research in the semiarid and humid tropics of Africa.

Dr. André Bationo, IFDC Soil Scientist, will take up his post at ICRISAT in Niger about April 15 to conduct the research phase concerned with the semiarid tropics. Another scientist will be posted at IITA to carry out the humid tropic phase of the project. Dr. Uzo Mokwunye and Dr. P.L.G. Vlek, Soil Scientists, are the IFDC counterparts for this project being funded by IFAD.

The overall goal of the project is to increase food production through more effective integrated nitrogen and phosphate fertilizer application, the development of more efficient management of nitrogen fertilizer, and efficient and cheaper sources of phosphate for different cropping and fallowing systems in both the wet and dry areas of Africa.

"The objectives of the phosphate component of the research are to determine the effectiveness of finely ground phosphate rock for food crop production, to determine the effectiveness of partially acidulated phosphate as a source of both phosphorus and sulfur for food crops, and to determine the most appropriate phosphorus fertilizer technology for food crops," Dr. Mokwunye said.

In January, Dr. Mokwunye, Dr. Vlek, and Dr. Bationo, along with collaborators from ICRISAT and IITA, designed the field trials that will be conducted during the 1982 rainy season. Field trials have been designed to make economic comparisons of phosphate fertilizer sources for food crop production. There will also be nitrogen management experiments in Niamey and in two locations in Nigeria. These experiments will monitor reactions of different nitrogen sources, methods of applying different sources to different crops, and the form in which different sources are applied.

"The overriding principle is to determine how fertilizer sources will perform in different cropping sequences in common use in these two agroclimatic zones," Dr. Mokwunye said.

In the semiarid tropics, millet and cowpeas will be planted in a mixture while maize and cowpeas will be relay-cropped in the humid tropics.

"In another type of experiment, we will try to monitor the maintenance of soil fertility in the presence or absence of adequate fertilizer in different cropping systems," Dr. Mokwunye said.

"Our intention is to take the model of these experiments and repeat it in experiment stations of national research centers. Ultimately we want to take it directly to farmers' fields," Dr. Mokwunye said.

The ultimate goal of the project is to develop recommendations for the farmer. "We hope to eventually be able to say 'This is the most economical source of phosphate for you, or this is the most efficient nitrogen source for your situation,'" said Dr. Mokwunye. "After the first year, the research will begin to move to farmers' fields."

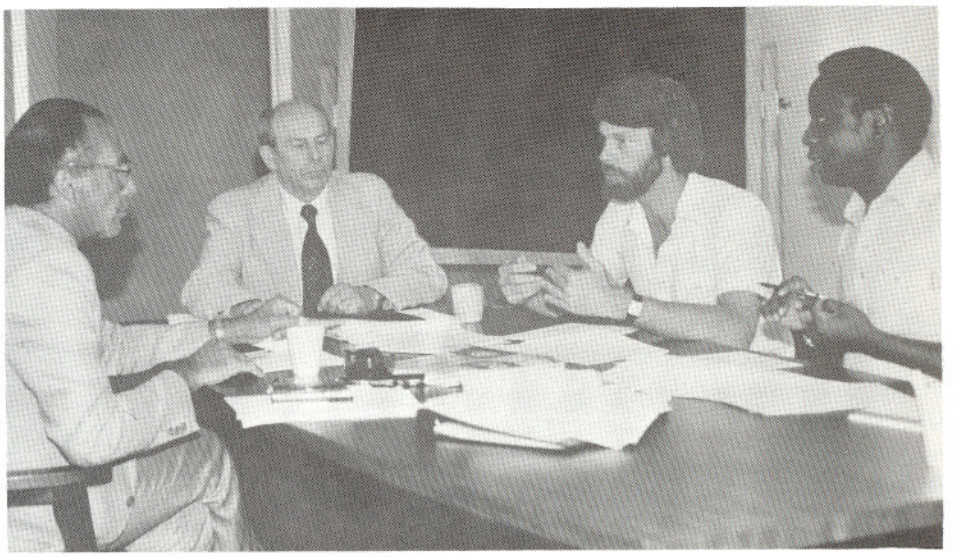
Part of the project will be concerned with developing the indigenous resources and seeing how the farmer can best utilize them. "We will be trying to utilize the phosphate deposits in Mali, Upper Volta, and Niger, among other places," Dr. Bationo said.

The project will also be concerned with the different cropping systems. "Some cropping systems are already being used by farmers," Dr. Bationo said. "We will compare these to cropping systems that are new to the farmers."

The low market demand for fertilizers and the high cost of energy for producing fully acidulated phosphate fertilizers hampers the growth of the fertilizer industry in Africa. "If we get good results from our research with partially acidulated phosphate rock, it will become more important to work with our indigenous resources to save money," Dr. Bationo said.

Under rainfed conditions in Africa, the researchers will also study the efficiency of three nitrogen sources, supplied by the IFDC Fertilizer Technology Division—prilled urea, calcium ammonium nitrate, and urea supergranules.

The project represents an integration of basic and applied research and development and evaluation in a setting of several international centers with considerable expertise to support this effort. It is hoped that this regional effort will not only help the small farmers grow more food but will aid in the development of personnel required to establish a viable fertilizer industry in Africa. ■



Dr. A. M. Kesseba, IFAD Technical Advisor (left); Dr. W. D. Bishop, Director, IFDC Agro-Economic Division; Dr. P.L.G. Vlek and Dr. Uzo Mokwunye, IFDC Soil Scientists and Coordinators of the IFAD project make final decisions regarding the project document.

Collaborative Project Approved by IITA/Netherlands Agricultural Research Organization/IFDC

The age-old tradition in west Africa of alternating cropping and bush fallow may soon be obsolete. The transition to modern crop sequences may be accelerated if success results from a recently approved collaborative project by IITA, the Netherlands Agricultural Research Organizations, and IFDC.

The project, entitled "Efficiency of N-Utilization in Farming Systems in the Humid Tropical Region of West Africa," began on November 1, 1981, with field investigations at IITA in Onne, near Port Harcourt, Nigeria. The project, sponsored by the Dutch agency for international collaboration (DGIS), involves the stationing of a Dutch soil scientist at the Onne station of IITA. Greenhouse and laboratory investigations will be conducted at IITA, IFDC, and the Netherlands.

The project coordinators are: Dr. A.S.R. Juo and Dr. B. T. Kang, IITA; Ir. Jan van der Heide, International Coordinator for the Institute for Soil Fertility, The Netherlands; and Dr. Paul L.G. Vlek, Soil Scientist, IFDC.

"With rapid population growth in west Africa, there is a growing demand to increase the productivity of the available land," Dr. Vlek said. "This can be achieved by increasing the yield per unit land area or by shortening or eliminating the relatively long fallow period. Shortening or eliminating the fallow period must be compensated for by the application of organic and/or chemical fertilizers.

Nitrogen is the most limiting nutrient for sustained crop production in the humid tropics. After a forest is cleared for cultivation, the soil is usually adequately supplied with nitrogen during the first year; however, the nitrogen supply usually declines rapidly during subsequent croppings with the decrease in soil organic level. Thus, as more land is cleared, there will be an increasing demand for supplemental nitrogen fertilizer in order to maintain productive continuous systems of cultivation.

"The objectives of the project are: (1) to study the fate of nitrogen in different crop sequences at the Onne site of IITA, (2) to examine nitrogen fertilizer use in the various crop sequences, and (3) to develop and evaluate improved fertilizer sources and fertilizer management practices for the selected crop sequences," Dr. Vlek said. ■

Training Programs

Continued from p. 3

Bahamas—

Granulation and Bulk-Blending Seminar Proves Practical

"I have a much better understanding of chemical fertilizer mixing and all that it entails. On a rating of 1 to 10, I would rate the seminar at 9.8." This was a critique of the second IFDC Regional Fertilizer Granulation and Bulk-Blending Seminar, made by Gustavo Berges, Vice President, Fertilizantes Quimicos Dominicanos, (FERQUIDO), Dominican Republic. The seminar was held on the Grand Bahama Island, November 16-20, 1981.

The program was under the direction of Mr. M. T. Frederick, IFDC Chemical Engineer. It focused on solutions to unique production problems in the production of multinutrient granular fertilizer and the increased use of bulk-blended fertilizers. The seminar was targeted for the Latin American and Caribbean basin region; 25 participants attended from 13 countries.

A wide variety of topics were discussed in the program. These included such subjects as inventory control, pollution control, plant design, new NPK technology, and quality assurance and control. The core faculty was from IFDC. Other faculty included representatives from fertilizer industries of North America, Latin America, the Caribbean region, and Europe.

The seminar organizers strived to give the participants practical information that they could apply in their fertilizer companies.

"There were a lot of points expressed that I can use in our own operation," Mr. Berges said. "Specifically, these involve controls or aids to determine actual shrinkage in different aspects of the process. I also plan to implement product specification sheets as soon as I return. These are being used by a lot of companies whose policies were presented during the seminar."

The seminar sought to find ways to solve specific problems in fertilizer plants.

"We must find ways to simplify a lot of our operations and reduce the costs of handling and related energy costs," Mr. Berges said. "During the seminar we were exposed to heretofore unused technologies, such as belt elevators."

The participants discovered new insights to problems they encounter in their plants every day. The high point of the seminar for Mr. Jose Rodriguez, Operations Manager of Petroquimica de Venezuela, S.A. (PEQUIVEN), Venezuela, was learning about the use of heats of reaction and liquid phase factors in NPK formulation.

"When formulating, we were only using the nutrient content of the raw materials in our calculations. The rest (heats and liquid phase) were done by trial and error," Mr. Rodriguez said.

"We add sulfuric acid, but to get the heat we don't know how much or what kind or when or why," he said. "This seminar clarified a lot of things for me. I now have information that will be helpful to the operations people in our NPK plant."

Summing up the overall impact of the seminar, Mr. Frederick said, "The participants were interested, attentive, and responsive and indicated that they gained much useful information." ■

Recent IFDC Publications

Economic Evaluation of Fertilizer Supply Strategies for the ASEAN Region: Linear Programming Approach

This study was undertaken to illustrate the use of a dynamic linear programming model for planning the development of a fertilizer industry. The model was applied to the countries of the ASEAN region.

Results of the study show the effect of different supply strategies on fertilizer cost. The study measures savings that could be realized through cooperative agreements. It also shows the added costs that the region will have to pay to achieve different degrees of self-sufficiency.

This joint publication of Institut fur Landwirtschaftliche Marktforschung (IfLM) of Braunschweig, West Germany, and IFDC was prepared by Lueder von Bremen, Economist, with Yao H. Chuang, Market Development Economist, Ray B. Diamond, Coordinator—Fertilizer Evaluations, Adolfo Martinez, Fertilizer-Use Economist, and Mohinder S. Mudahar, Economist.

Please request Technical Bulletin T-21 in ordering this publication. The price of the publication is US $5 within the United States and US $7 for international mail. ■

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World Fertilizer Progress into the 1980s

The world fertilizer sector is in a process of dynamic expansion in terms of quantities of fertilizers involved and the number of producers. Many countries in the world, and especially in the developing regions, are devoting special efforts to develop optimum policies with regard to domestic fertilizer production and fertilizer supply. Continuous changes in the nature of the fertilizer sector in light of the crisis of 1973/74 make accomplishments more difficult to achieve. The lack of fertilizer availability at the right place, the right time, and the right price is one of the major constraints on increasing food production. Acknowledging the increased importance of fertilizers to food production, most governments have assigned a higher priority to fertilizer supply schemes.

This publication, written by Joseph Lastigzon, Economist, attempts to analyze the changing patterns of world fertilizer production and consumption and underline the major trends in this sector. Based on an evaluation of the changes during the 1970s and discussion of the projections made by the FAO/UNIDO/World Bank Working Group on Fertilizers for the first half of the 1980s, it attempts to provide a useful analysis of fertilizer production, consumption, and trade. Policymakers in the developing countries should find this paper very helpful in their attempts to rationalize their fertilizer supply sector in the 1980s by means of domestic production and imports.

In ordering this publication, please request Technical Bulletin T-22. The price of the publication is US $3 within the United States or US $6 for international mail. ■

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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