

## IFDC Prepares New Manual on Fertilizers

A new fertilizer manual, written to be a reference source on fertilizer production technology and economics and fertilizer industry planning for developing countries, is underway under the direction of Mr. Travis Hignett, IFDC Special Consultant.

The new manual, a joint project between IFDC and the United Nations Industrial Development Organization (UNIDO), is designed to replace the old UN Fertilizer Manual published in 1967. The aim of the new manual, according to Mr. Hignett, is to "describe in clear, simple language all major fertilizer processes, their requirements, advantages and disadvantages and to show illustrative examples of economic evaluations."

The manual is organized in five parts. Part I deals with the history of fertilizers,

world outlook, the role of fertilizers in agriculture, raw materials, and a glossary of industrial terms.

Part II covers the production and transportation of ammonia and all important nitrogen fertilizers—liquid and solids.

Part III deals with the characteristics of phosphate rock, production of sulfuric and phosphoric acid, and all important phosphate fertilizers including nitrophosphates and ammonium phosphates.

Part IV deals with potash fertilizers—ore refining and chemical manufacture; compound fertilizers; secondary and micronutrients; controlled-release fertilizers; and physical properties of fertilizers.

Part V includes chapters on planning a fertilizer industry, pollution control, and the economics of production and trans-

portation of major intermediates.

Contributing authors outside IFDC include individuals from the World Bank, UNIDO, and TVA.

The publication is targeted for completion in late 1978. Distribution will be handled jointly by IFDC and UNIDO.



Mr. Travis Hignett

### EFFICIENCY OF NITROGEN FERTILIZERS ON RICE—

## Collaborative Research Project With IRRI

IFDC Soil Scientist Dr. Eric Craswell begins a 2-year assignment in January 1978 at the International Rice Research Institute (IRRI) as part of a collaborative research effort by the two organizations on ways to increase the efficiency of nitrogen fertilizers for rice.

The joint IFDC-IRRI research program, according to Dr. Paul Stangel, IFDC Deputy Managing Director, aims to develop and help introduce more effective nitrogen fertilizer materials and management practices for lowland rice-growing areas.

An important and necessary research step toward improving the utilization of fertilizer nitrogen by lowland rice, says Craswell, IFDC's project coordinator at IRRI, "will be basic studies to identify the transformation and utilization processes that affect nitrogen recovery by rice under Asian field conditions where the crop is grown. The research will focus on determining the role of nitrogen losses and will be coordinated closely with work conducted under

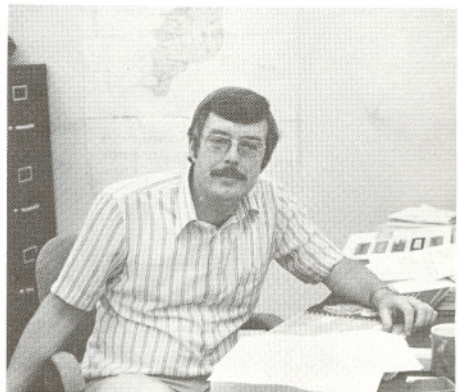
controlled conditions at IFDC headquarters."

The collaborative program, as envisioned by the two organizations, will attempt to integrate all levels of research from the basic laboratory and greenhouse work to applied and adaptive research on farmers' fields. The applied research will examine the effects of nitrogen fertilizer sources and management on efficiency in relation to environment and crop and water management. The International Network for Fertilizer Efficiency for Rice (INFER), a research network involving eight Asian countries, will play an important role in this research. The adaptive research activities will center initially on field-level studies using, at first, currently available new materials such as sulfur-coated urea (SCU) and urea supergranules.

However, as information on the mechanisms of loss and the performance of different N-fertilizer materials under Asian conditions becomes available, IFDC engineers and chemists will be working with the data to design more efficient

nitrogen materials and application techniques for subsequent testing and development.

The combining of IFDC's expertise in fertilizers and fertilizer technology and IRRI's knowledge of rice cultivation in Asia offers a potentially unique research opportunity to identify ways to accelerate the quest for higher rice productivity in Asia through more efficient sources of N and improved cultural practices.



Dr. Eric Craswell

# IFDC To Initiate Research Program on Sulfur

The increasing incidence of sulfur deficiencies throughout the tropics combined with the declining popularity of sulfur-containing fertilizers, such as ammonium sulfate (AS) and single superphosphate (SSP), has led IFDC to initiate a research program on ways to meet the sulfur requirements of tropical agriculture.

Dr. Graeme Blair, acting as an IFDC consultant while on sabbatical leave from the University of New England, Australia, prepared a position paper documenting the need and possible objectives for a

research program on sulfur. This report has served as a starting point for IFDC to develop a program to evaluate and modify currently available sulfatic fertilizers to meet the needs and conditions of tropical soils and crops.

IFDC is now in the process of equipping a soil microbiology laboratory for research on sulfur and its interactions with other nutrients. Staff will be hired in 1978 to map out program activities in greater detail. In a general sense, however, the program will include workshops and other meetings to bring sulfur researchers

from developing countries together; laboratory studies to survey, identify, and, if necessary, develop more accurate methods of determining sulfur in soil and plant samples; laboratory and greenhouse studies on fertilizer reactions in tropical soils in the presence of plants to ascertain both the release pattern of fertilizer S and its effect on soil reaction (pH) and on the availability of other nutrients; and field studies to determine the agronomic efficiency and residual value of various sulfur sources and the long-term consequences on soil pH and nutrient supply of various treatments.

## COMBINING DEEP PLACEMENT AND CONTROLLED RELEASE—

# Greenhouse Studies on Modified Urea Materials

The prevailing fertilizer application method in rice farming, that of broadcasting urea with only minimal incorporation into the soil, leads to nitrogen losses in the order of 40-70% of the actual nutrient applied.

Research to date has identified three primary methods to reduce such nitrogen losses. These are: (1) split applications so that nitrogen is applied during peak crop demand periods to minimize the quantity of fertilizer nitrogen susceptible to losses; (2) deep placement of the fertilizer nitrogen in the active rooting zone of the plant and beneath the oxidized layer; and (3) various coatings and inhibitors to control and time the release or availability of the nitrogen in soil to match more closely the needs of the plant.

Each of these methods has some disadvantages. Split surface applications and ways to place sufficient nitrogen into the reduced plowed layer have required considerable extra labor, which often has not been available. Coated materials, such as sulfur-coated urea (SCU), while more effective than straight urea, have not always improved yields sufficiently to offset a 30-40% higher cost of production.

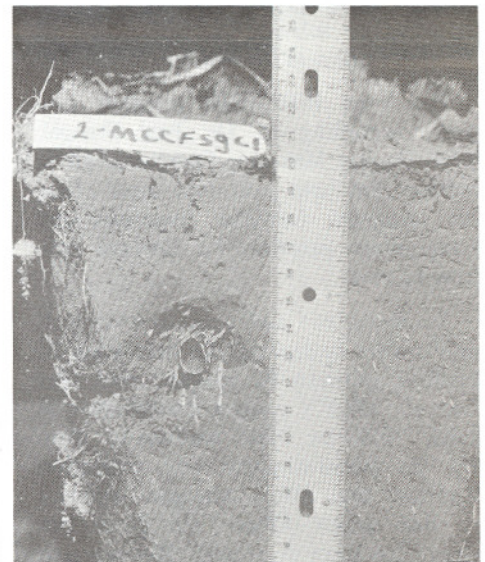
A new approach under study at IFDC is to produce a sulfur-coated urea supergranule (SCSG) (1-3 grams) for deep placement. This approach offers a number of potential advantages over past methods. First, it provides sufficient nitrogen in a single application to meet the needs of the rice crop. Secondly, the combination of coating the supergranule and deep placement substantially reduces nitrogen losses through leaching and volatilization. Thirdly, costs of coating will probably be less because the total surface area is smaller. The coating reduces root damage in the area surrounding the supergranule.

In a recent IFDC greenhouse experiment, using IR 38 rice, SCSGs (1 gram, 10 mm) placed at a depth of 8 cm in the soil, were compared under two flooding regimes—continuous and intermittent—with other nitrogen fertilizer materials and application methods. Apparent plant recovery of nitrogen from the SCSG averaged 83% compared to only 27% for broadcast applications of ordinary urea. It should be noted, however, that the possibilities for leaching losses were eliminated in this experiment. SCSG also outperformed supergranules placed in the active rooting zone, as well as basally-applied SCU and ordinary urea with split application.

The SCSG is only an example of experimental materials developed as part of the IFDC program to evaluate and modify various urea materials and cultural practices which provide more

efficient (both agronomically and economically) use of fertilizer nitrogen.

The program at IFDC, however, goes much deeper than just modification of existing materials. Basic soils research is underway to assess quantitatively the importance of the different mechanisms of nitrogen loss. Recent research at IFDC and IRRI suggests that ammonia volatilization, contrary to past thinking, may cause extensive losses, especially from urea which, upon hydrolysis, provides its own alkalinity to promote ammonia loss. These results suggest that more research is needed to understand more fully the mechanisms of nitrogen loss to provide IFDC engineers a rational basis for the development of new and more efficient nitrogen fertilizers, better tailored to the conditions of rice and other crops grown in the tropics. Such basic research is continuing at IFDC.



Those plants fertilized with sulfur-coated supergranules (SCSGs) placed at a depth of 8 cm in the soil had the highest average vegetative and rough rice yield when compared with plants fertilized with other materials and application methods. Plant roots tended to grow towards the SCSGs. The nitrogen leaked out through cracks in the sulfur coating leaving empty shells by harvest time.

# ASEAN Region Fertilizer Study

An in-depth study to assess the comparative economic advantages and disadvantages of alternative fertilizer supply strategies in the ASEAN region of Southeast Asia during 1979-89 is underway in cooperation with the ASEAN Committee on Industry, Minerals, and Energy and three member countries. Included in this study is the possibility for regional cooperation in fertilizer industry development and trade among member countries.

The study, under the coordination of Dr. Yao Chuang, IFDC Economist and Coordinator of the World Fertilizer Information Service, is a joint project between IFDC and government and industry representatives from Indonesia, Malaysia, and the Philippines. Thailand has indicated an interest in the study, but has not yet participated.

The current study, using the most current data and a recently developed

IFDC computer model, is an outgrowth of a previous 1975 IFDC/World Bank report on the same region. Expanded considerations in the new study include: (1) possible noncoastal production sites; (2) production of NPK by granulation or bulk blending; (3) the optimal timing of investment and trade expansion; and (4) economies of scale in plant investment and production.

Five basic scenarios, using assumptions agreed upon by all study team participants, have been identified for computer model analysis. These scenarios range from a policy of complete self-sufficiency in fertilizer production for each country in the ASEAN region to situations where fertilizer demand can be met through either regional production or importation from outside the region.

The evaluation of these different scenarios is expected to be completed in mid 1978.



## COLLABORATIVE RESEARCH WITH BRRI—

### Adoption/Demand Project in Bangladesh

A collaborative research project to identify the principal fertilizer adoption and demand constraints and to develop public policies to help relax these constraints has recently been initiated by the Bangladesh Rice Research Institute (BRRI) and IFDC.

The main objectives of the 2-year study according to Dr. S. S. Sidhu, IFDC Team Leader, are to (1) identify the principal constraints to the expansion of economically sound use of fertilizer among rice producers in selected regions of Bangladesh; (2) suggest alternative policy measures to remove such constraints; and (3) demonstrate the use of research information and economic analysis to increase fertilizer use and agricultural productivity in Bangladesh.

Basic data will be generated from a farm-level survey carried out in four regions of Bangladesh over a 10-month period. The data will then be analyzed at BRRI and IFDC.

The Bangladesh project is one of several that IFDC is in the process of establishing with various national institutions in the developing countries.



IFDC Economists, Dr. Carlos Baanante (second from left) and Dr. Surjit S. Sidhu (not pictured) visit Bangladesh farmers with BRRI Economist, Dr. Ekramul Ahsan (third from left), in connection with the joint IFDC-BRRI farm-level research project on fertilizer adoption and demand.

## Rotary Fellowship Sends Engineer From India For 1 Year Training Program

A chemical engineer, Mr. Prakash Acharya, from the Mangalore Fertilizer Company in India has begun a 1-year program of training at IFDC through a Rotary Foundation fellowship.

Mr. Acharya has served Mangalore Fertilizer Company for 3 years as a shift leader for an ammonia plant. While at IFDC, he is broadening his work experience as a team member in IFDC's wet-process phosphoric acid research group, which currently operates a bench-scale wet-process acid unit.



Mr. Prakash Acharya (in background) pictured discussing his program of work with IFDC staff member, Mr. Manuel Sanchez.

Researchers at IFDC hope to be able to generalize the research findings from national-level projects to make the research results useful to more countries.

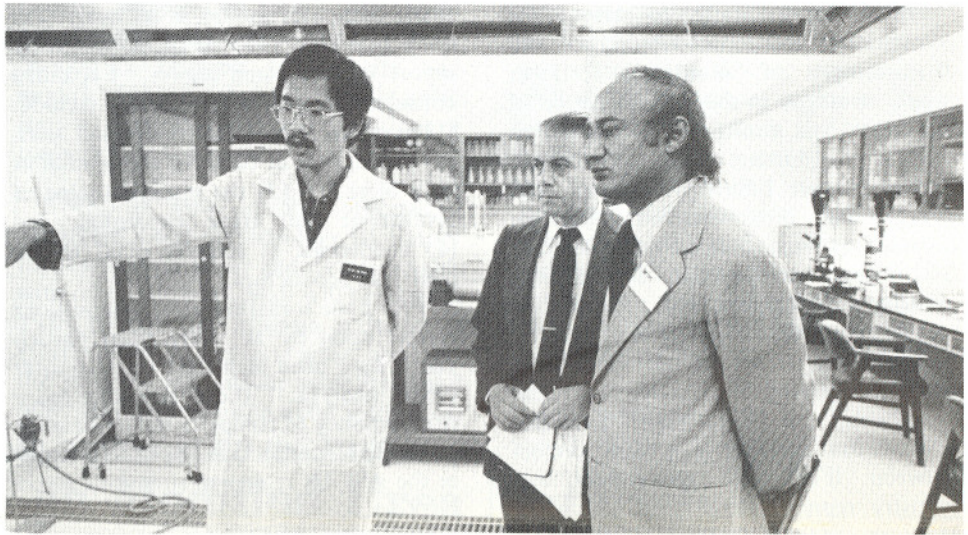
# Visitors Program Continues To Expand

An international development organization like IFDC depends on frequent and continuing contact with other organizations to develop and carry out its programs in fertilizer research and development, technical assistance, and training.

During the first 2-1/2 years of operation, over 700 visitors have traveled to Muscle Shoals for general orientations and in-depth discussions with the fertilizer staffs of both IFDC and TVA.

In 1977, IFDC received nearly 500 visitors, seminar participants, and trainees representing 58 countries. For each visitor to IFDC a program of orientation, meetings, and discussions is arranged and coordinated through the office of Mr. Manuel Sanchez, Special Assistant to IFDC's Managing Director. The interests of visitors meeting with IFDC's staff of engineers, geologists, soil scientists, economists, and market development specialists have covered a wide range of subjects such as: characterization and utilization of raw materials, fertilizer manufacturing processes, factory maintenance, and pollution control; soil science research on nitrogen, phosphorus, and sulfur fertilization; bulk-blending operations; fertilizer distribution and marketing systems; and market intelligence and investment cost information.

Countries, other than the United States, accounting for the largest number of visitors include Brazil, India, Mexico, Japan, Bangladesh, Korea, Israel, Indonesia, United Kingdom, Colombia, Ghana, Taiwan, Pakistan, Venezuela, and Hungary. These individuals represent the main national and international organizations, public and private, concerned with



A typical IFDC visitor was Dr. M. Afzal Mirza, Chief Chemist for Dawood Hercules Chemicals Ltd., Pakistan. Dr. Mirza spent a day talking to engineers and scientists in the Fertilizer Technology and Agro-Economic Divisions. Pictured are IFDC staff members, Dr. Peter H. Peng (left), Mr. Manuel Sanchez (center) with Dr. Mirza (right) during an orientation discussion on IFDC's wet-process phosphoric acid research program.

the role of fertilizer in agricultural development.

This continuing and growing interaction between IFDC staff and individuals from fertilizer-related organizations

throughout the world is a key factor in IFDC's mission to assure that adequate fertilizers and fertilizer know-how exist to accelerate agricultural development in developing countries.

## PUBLICATIONS AVAILABLE FROM IFDC

"Granular Urea—Advantages and Processes," published by IFDC.

"The Potential for Regional Cooperation in Fertilizer—A Methodology Study of the ASEAN Group," published by IFDC.

"Supplying Fertilizers for Zaire's Agricultural Development," published by TVA.

"West Africa Fertilizer Study (Volumes I-VII)," published by IFDC.

Volume I—Regional Overview

Volume II—Senegal

Volume III—Mali

Volume IV—Upper Volta

Volume VI—Chad

"Ghana—Progress in Fertilizer Production, Marketing, Education," published by TVA.

"Suggested Fertilizer-Related Policies for Governments & International Agencies," published by IFDC.

"Progress Report, 1975-1976," published by IFDC.



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