IFDC

Report

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

Headquarters—

Inhibitors Show Promise in Reducing Nitrogen Losses

Recent results from IFDC greenhouse tests with flooded rice suggest that urease inhibitors added to topdressed urea fertilizer can reduce nitrogen losses significantly.

As shown in the article, "Philippines—Results Show Magnitude of Ammonia Losses," (this issue) ammonia loss is the main problem encountered in the efficient use of urea for rice. Thus far, the two most effective ways IFDC researchers have found for reducing this loss are (1) deep placement of supergranules into the paddy soil and (2) surface application of a slow-release urea fertilizer.

IFDC soil scientists and fertilizer technologists are now studying an alternative method that involves using an inhibitor to delay the conversion of urea to ammonia.

"In this way, the plants have a chance to compete with ammonia loss," Dr. E. T. Craswell, IFDC Soil Scientist, said. "This method works best when fertilizer is applied when the plant is growing fairly vigorously. The figure (page 2) shows that a chemical compound called phenyl phosphorodiamidate (PPD) increases recovery of urea by rice and reduces losses from 23% to 0%."

PPD inhibits or slows the decomposition of urea fertilizer to ammonia and carbon dioxide. The decomposition process is initiated by an enzyme called urease, which is present in soil. As a urease inhibitor, PPD prevents or slows this reaction.

"We have been studying the basic chemistry of PPD to learn what makes it an effective urease inhibitor," Dr. M. S. Lupin, IFDC Chemist, said. "We are accelerating our research on the mechanism of its action and hope that we can develop lower cost materials."

"The real promise of this method is that it would not involve any change in present farming practices," Dr. Craswell said. "It would only involve the inclusion of a small amount of the inhibitor in the urea that the farmer buys."

"The preliminary results in the greenhouse are exciting; we now need to test the material in the field," Dr. Craswell said. "IFDC is presently evaluating the urea-PPD product in the Philippines in cooperation with the International Rice Research Institute (IRRI) and in the Fujian Province in the People's Republic of China, in cooperation with the Fujian Academy of Agricultural Sciences."

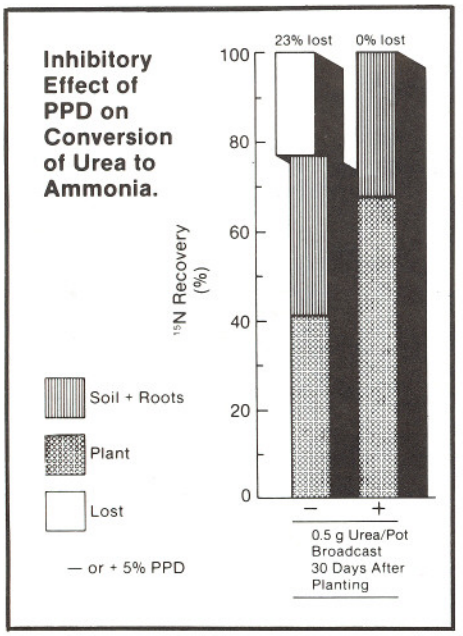
The work that the IFDC researchers are doing is especially important to the rice-growing areas of the developing world since urea is the primary fertilizer used in these regions. Urea fertilizer is rapidly converted to ammonia in tropical soils because of the high soil temperatures.

If ammonia losses can be reduced, the Asian rice farmer may enjoy double the present benefits from applied urea. This will result in more rice being produced

Dr. Mohinder S. Mudahar, IFDC Economist, and Mr. Travis P. Hignett, Chemical Engineer and Special Consultant to the Managing Director, present a copy of their recent publication, *Energy and Fertilizer*, to Dr. Donald L. McCune, IFDC's Managing Director. (See page 8 for more particulars on this publication.)

In this issue . . .

to feed the world's hungry and more money placed in the pockets of the rural poor. ■



Headquarters—

Modified Phosphate Fertilizer Production Process Developed

IFDC fertilizer technologists have developed a modified phosphate fertilizer production process to provide an improved phosphate material for mixing with urea-based products.

The principal researchers conducting this work, which was begun in November 1981, were Mr. J. J. Schultz, Engineering Coordinator; Mr. J. R. Polo, Deputy Engineering Coordinator; and Mr. G. W. Bolds, Pilot-Plant Operations Coordinator.

"The product (ammoniated granular superphosphate) was designed to more closely fit the requirements of the urea-based fertilizer mixer and of the farmer in the tropics where acidic soils and long growing seasons predominate," Mr. Schultz said. "The development of the process was also designed for maximum use of existing granular triple superphosphate and compound fertilizer production facilities in the developing world."

Urea is the major source of nitrogen fertilizer in the developing world, but in many cases urea or other straight nitrogen fertilizers do not completely satisfy the crop nutrient needs. For example, in field tests conducted by the Food and Agriculture Organization of the United Nations, straight nitrogen was found to be the best treatment in only 2 out of 41 tests carried out in 13 countries.

Furthermore, the mixing of urea with certain common phosphate, potassium, and magnesium materials used to produce compound fertilizers often adversely affects the processing and physical characteristics of the products. Mixtures of urea and superphosphate are especially prone to undesirable reactions that lead to product deterioration and caking.

"Diammonium phosphate (DAP) is the most compatible and frequently used source of phosphate for preparing compound fertilizers containing urea," Mr. Polo said. "A large number of nitrogen, phosphate, and potassium nutrient ratios can be prepared using urea, DAP, and potassium chloride. Bulk blends or granular compounds made from these materials are relatively stable and usually exhibit good storage and handling characteristics, and the difficulties associated with mixing urea and superphosphate are eliminated."

In tests conducted in the IFDC Pilot Plant, the physical properties and storage characteristics of compound fertilizer mixtures containing urea and the modified phosphate fertilizer were superior to mixtures made using superphosphates. Preliminary agronomic data indicate that the performance of the modified phosphate was equal to that of granular triple superphosphate or DAP.

Mr. Jorge Polo will present a paper detailing the results of this research at the Fertilizer Industry Roundtable, in Atlanta, Georgia, October 26-28. ■

Mr. George Bolds, IFDC Pilot-Plant Operations Coordinator, examines product from the granulator.

Bangladesh—

IFDC Completes Fertilizer Supply and Use Policy Study

A key element in Bangladesh's plans to raise food production to self-sufficiency levels is increased and more efficient use of fertilizer.

In an effort to assist Bangladesh in achieving this objective and at the request of the Bangladesh Agricultural Development Corporation (BADC), IFDC has completed a study entitled "Bangladesh—Policy Options for the Development of the Fertilizer Sector." The report was presented to BADC at a meeting in Dacca on July 13.

IFDC staff members involved in the presentation of the study include Dr. E. C. Kapusta, Regional Coordinator—Asia; Dr. R. B. Diamond, Coordinator—Fertilizer Evaluations; and Dr. S. S. Sidhu, Economist. Mr. A. M. Anisuzzaman, the Secretary of the Ministry of Agriculture and Water Resources, chaired the meeting, which was attended by senior planners, administrators, and scientists involved in fertilizer supply and use policy development. Representatives of the U.S. Agency for International Development (USAID), the World Bank, and the Food and Agriculture Organization of the United Nations (FAO) were also present.

"Those in attendance discussed the policy actions needed to ensure the adequate, timely, and cost-efficient use of fertilizers," Dr. Kapusta said.

The policy options report prepared by IFDC was based on state-of-the-art background papers prepared by senior Bangladeshi and IFDC fertilizer specialists. The report was prepared in response to BADC's need for more clearly defined and coordinated fertilizer supply and use policies consistent with the Government of Bangladesh's agricultural development plans and food production targets.

The study was carried out as an activity under the IFDC/BADC Fertilizer Marketing and Distribution Consultancy Services Agreement funded by USAID. ■

IFDC in the Field

Philippines—

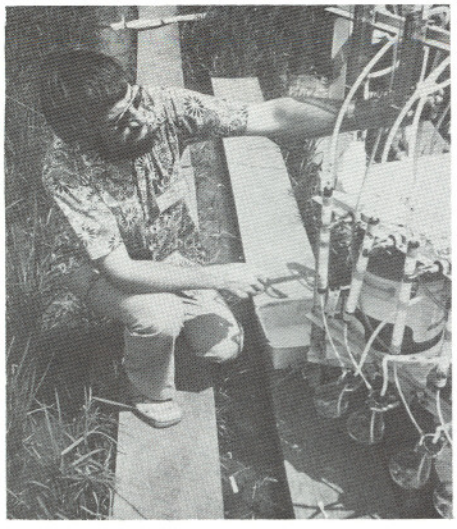
Research Results Show Magnitude of Ammonia Losses

Research results obtained by an IFDC soil scientist outposted to IRRI have shown that up to 50% of the urea broadcast by Asian farmers can be lost in 1 week after application during the dry season.

Dr. I.R.P. Fillery, IFDC Soil Scientist, revealed these results at a meeting held at IFDC, July 19-23. The purpose of the meeting was to review the progress of the past 5 years' cooperative research between IRRI and IFDC. This research has centered on nitrogen fertilizer efficiency for rice.

One of the highlights of the review was Dr. Fillery's discussion of the results obtained using a micrometeorological method of measuring ammonia losses from urea in the field at the Maligaya Rice Research Training Center in the Philippines. Dr. Fillery's work has been conducted in cooperation with Dr. S. K. De Datta, Agronomist and Head, Department of Agronomy, IRRI, and Dr. J. R. Simpson, Principal Research Scientist, Commonwealth Scientific and Industrial Research Organization (CSIRO), Australia.

"These results confirm research conducted under controlled conditions at IFDC 5 years ago that suggested that ammonia loss was important," Dr. Fillery said. "Our work in the field has settled any arguments about the importance of ammonia losses. Losses were greatest when urea was broadcast into the floodwater 2 weeks after transplanting which is the method used by many Asian rice farmers."



Dr. I.R.P. Fillery, IFDC Soil Scientist, checks equipment for measuring ammonia volatilization in the field at IRRI.

Other results discussed at the meeting concerned research on polymer-coated urea (PCU). Field research on PCU developed by the Korea Advanced Institute for Science and Technology for IFDC has shown it to be a very efficient fertilizer for irrigated rice and comparable to sulfur-coated urea, which was developed by the Tennessee Valley Authority (TVA). However, such slow-release fertilizers are presently too costly and may not be available to Asian farmers in the near future. Discussion at the meeting therefore focused on the deep placement of urea supergranules, a technology which had been reviewed at the IFDC workshop on nitrogen management for rice held in Fuzhou, China, in April. Plans for farm-level tests of urea supergranules and the development of urea supergranule applicators were discussed.

"While we have a lot of information on the causes of the inefficiency of urea for irrigated rice, we now need to focus on the causes of the inefficiency and ways of improving fertilizers for rainfed rice," Dr. Fillery said.

Dr. Fillery has started work using the isotope ^{15}N in the field to determine how the soil-water regime influences the efficiency of urea. Results show that when the soil undergoes wetting and drying, the loss of nitrogen fertilizer is increased. The use of urea supergranules improves the efficiency of nitrogen under these conditions, but efficiency is lower than under irrigated conditions.

Further research on rainfed rice will emphasize the interaction between the plant, fertilizer, and rainfall in determining fertilizer efficiency. ■

India—

Soil Scientist Stresses Potential for Increased Agricultural Production in India

"The potential for increased agricultural production on the Vertisols of India is immense. The millions of hectares of Vertisols have the characteristic of holding moisture; this is like 'money in the bank.' The production potential is great since water is available."

Such was the way Dr. J. T. Moraghan, former IFDC Soil Scientist, who was outposted to the International Crop Research Institute for the Semiarid Tropics (ICRISAT) in Hyderabad, India, during 1980-82, described the agricultural potential of the ICRISAT mandate area. Dr. Moraghan presented the results of his 2-year study at ICRISAT in a seminar at IFDC Headquarters, July 16.

Dr. Moraghan conducted collaborative research with ICRISAT scientists on nitrogen fertilization of rainfed cereal crops in the semiarid tropics. Initial emphasis was placed on sorghum since it is a principal food crop in the semiarid tropics.

"Sorghum is very important in India," Dr. Moraghan said. "Many of the Indian villages prefer sorghum over the other grains as a food."

Because the requirements and effectiveness of nitrogen fertilizer is greatly affected by soil type, research was conducted on both red soils (Alfisols) and black, clay soils (Vertisols), the two major soils in the Indian semiarid tropics. Use of fertilizers containing ^{15}N, a nonradioactive form of nitrogen, enabled the scientists to measure the losses and plant uptake of nitrogen fertilizer.

"Our research revealed that nitrogen fertilization dramatically increased yields of sorghum grain on both the red and black soils,"Dr. Moraghan said. "Timing and placement of nitrogen fertilizer

markedly influenced yield. Greatest grain yields on both the black and red soils were obtained when nitrogen fertilizer was divided into two applications and placed in the soil near the plant row."

Only a fraction of the applied nitrogen fertilizer was actually taken up by crops on both the red and black soil. Sorghum took up between 30% and 65%, and the remainder was either left in the soil or lost as gases.

"During 1981, a particularly wet year, approximately one-fourth of the urea fertilizer either broadcast on the soil surface or uniformly incorporated into the black soil at planting was lost as volatile gases on the black soil," Dr. Moraghan said.

It appears that denitrification, a microbial process whereby fertilizer nitrogen is converted by soil microorganisms to gases which escape to the atmosphere, was a likely cause of nitrogen fertilizer losses on the black soil. Denitrification is intensified by very wet soil conditions, and losses were greater in the wet year 1981, than in 1980 when the rainfall was approximately 400 mm less.

Research conducted by Dr. Moraghan in collaboration with ICRISAT scientists showed that more intensive use of black soils, traditionally left fallow during the rainy season, will require much more use of nitrogen fertilizer.

Fertilization of the post-rainy season cereal crops poses problems. Broadcasting the fertilizers on the soil surface is not effective because surface soil moisture and rainfall are not available to move the fertilizer to crop roots.

Research showed that deep placement of fertilizer at a depth of 20 cm gave the greatest grain yields. However, poor farmers in the semiarid tropics lack adequate equipment for deep placement of fertilizer. Thus, ways to ensure adequate supplies of plant nutrients deep in the soil profile where available water is located must be found for post-rainy season cropping.

"IFDC has a real role to play in conjunction with ICRISAT in ensuring that the necessary technology is available to increase food production in the semiarid tropics," Dr. Moraghan said.

The IFDC/ICRISAT collaborative research program is continuing; Dr. C. W. Hong, Soil Scientist, has been outposted to ICRISAT since April 1982.■

A field assistant harvests sorghum heads in a cooperative experiment at ICRISAT.

Headquarters—

PPI Representatives Present Seminar

Two representatives of the Potash and Phosphate Institute (PPI) presented a seminar at IFDC Headquarters on June 16. Dr. Kenneth M. Pretty, Senior Vice President, Potash and Phosphate Institute, Toronto, Canada, and Dr. Helmuth von Uexkull, Head, Potash and Phosphate Program for East Asia, Singapore, spoke on the "Problems and Potentials for Fertilizer Use in Asia."

"PPI has recently adopted a philosophy that if we are going to see an expansion in potash and phosphate consumption and a consequent increase in food production, we cannot consider the use of these nutrients in isolation," Dr. Pretty said. "We must look at the nutrient package in terms of how it interacts with other agronomic practices. For too long we have been concerned about small incremental increases in yield that might be brought about by a particular fertilization practice such as phosphate or potash. But we have not looked at the total package and how nutrients can interact with some of these other factors."

In their slide presentations, Dr. Pretty and Dr. von Uexkull discussed various problems related to fertilizer use in Asia.

"In Southeast Asia, fertilization or mineral stress is the largest single factor as far as soil limitations are concerned," Dr. Pretty said.

The two PPI representatives discussed in detail the exciting developments in the People's Republic of China and also the constraints to agricultural production in that country.■

Rice in some areas of China is cultivated on contours to conserve moisture and prevent erosion. (Photo: courtesy PPI)

Training Program Activities

Mexico—

Fertilizer Granulation and Bulk-Blending Seminar Held in Cancun, Mexico

A regional seminar on granulation and bulk blending of fertilizer was held in Cancun, Mexico, May 23-28, sponsored by IFDC and cosponsored by Fertilizantes Mexicanos, S.A. (FERTIMEX).

Designed for engineers working in the manufacture of fertilizers, mainly in Latin America, the seminar was conducted in Spanish and covered various practical technical aspects of fertilizer granulation and bulk-blending plant operation and design.

Some of the subjects discussed were the fundamentals of granulation, selection of equipment, pollution control, development of the Mexican fertilizer industry, bulk-blending practice in developing countries, and methods for formulation of fertilizers. In addition, various methods for granulation were discussed including steam granulation, ammoniation-granulation, and use of the pipe-cross reactor.

Mr. J. R. Polo, Deputy Engineering Coordinator, was the seminar manager. Other IFDC staff making presentations were: Mr. M. T. Frederick, IFDC Chemical Engineer and Co-Manager of the seminar; and Dr. R. T. Smith, Training and Manpower Development Coordinator.

"One speaker outlined the importance of bulk blending in the Caribbean region and another described installation of a typical bulk-blend plant for Latin America," Mr. Polo said. "Different processes and equipment were discussed as well as problems associated with bulk blending, including quality control, quality control legislation, raw materials specifications, and compatibility of raw materials."

Though bulk blending of fertilizers has been used in the United States for about 30 years, it is relatively new technology for some of the Latin American countries. Bulk-blending techniques that are used in the United States are not always suitable for other countries. For example, blended fertilizer in Latin America must be bagged, stored, and distributed to farmers. This distribution system also fits the needs of countries where farms are small and application of fertilizers is not highly mechanized. However, it requires more emphasis on good storage properties of the bagged mixtures and uniformity of analysis than is necessary when the blends are mixed, transported to farmers in bulk, and applied by mechanical spreaders the same day, as is often the case in the United States.

"Studies by IFDC and others for development of fertilizers that are more suitable for tropical agriculture were reviewed," Mr. Polo said. "Other presentations dealt with techniques for the efficient use of existing fertilizers to increase yields."

Extensive discussions followed the presentations and provided an opportunity for exchange of views between the speakers and audience. There were 42 participants, including speakers, from 10 different countries: Mexico, the Dominican Republic, Panama, Belize, Spain, the Federal Republic of Germany, Colombia, Ecuador, Venezuela, and the United States.

IFDC has held two similar regional seminars on granulation and bulk blending since 1980—one in Southeast Asia (Bangkok) and one in the Bahamas. But for the first time, at the Cancun seminar four commercial companies were invited to make presentations related to their equipment and company experience with specific projects in the Latin American region. These presentations highlighted various aspects of the particular projects: engineering planning, equipment, problems involved and solutions. The presentations were offered in the evenings as an addendum to the program, and the participants attended on a free-choice basis.

IFDC is assisting in a similar program in November of this year in Malaysia. The Malaysia program will be cosponsored by the Fertilizer Advisory Development and Information Network for Asia and the Pacific (FADINAP)/Economic and Social Commission for Asia and the Pacific (ESCAP), and the National Farmers Association of Malaysia (NAFAS). ■

Ing. Adolfo Sisto V. of FERTIMEX makes a point during the seminar.

Sri Lanka—

IFDC Conducts First Country-Specific Fertilizer Marketing Training Program

An inspiring lamplighting ceremony opened the first IFDC-country specific fertilizer training program in Sri Lanka on May 31.

This fertilizer marketing training program evolved as a direct result of an IFDC technical assistance project conducted for the Sri Lanka Ministry of Coconut Industries. A segment of the IFDC-

developed plan to increase Sri Lanka's coconut production called for the training of a special task force for the marketing of fertilizer for coconut.

After the Ministry of Coconut Industries initiated the program plan, the Fertilizer Secretariat coordinated the program for the benefit of the total Sri Lanka fertilizer industry.

Mr. L. B. Williams, IFDC Regional Coordinator for Africa, was the program manager. Other IFDC staff members making presentations were Mr. R. S. Giroti, Associate Training Coordinator, and Mr. G. T. Harris, Economist. Representatives of various fertilizer research and extension organizations made presentations to the group.

The program's objective was to train the staff of the fertilizer marketing system. They, in turn, will conduct similar mini-training programs for their respective organizations.

The program, sponsored by USAID and the Federal Republic of Germany, served 34 participants. The participants were middle-level fertilizer management personnel. "I was very impressed with the caliber of participants selected by Sri Lanka and their interest in the marketing discussions," Mr. Harris said.

Presentations were given on such topics as: "Components of an Integrated Fertilizer Marketing System Designed to Meet Sri Lankan Requirements," "Fertilizer Products in Sri Lanka—'What's in the Bag,'" and "Economics of Fertilizer Use in Sri Lanka."

The speakers represented such organizations as the National Fertilizer Secretariat; the Central Agricultural Research Institute; the Coconut Research Institute; the Colombo Commercial Fertilizer Company; the Ceylon Fertilizer Corporation; the Department of Agriculture, Peradeniya; the University of Peradeniya; the Coconut Cultivation Board; the Agrarian Research Institute; the Janatha Estates Development Board; the People's Bank; and the Bank of Ceylon.

One of the highlights of the program was a panel discussion conducted by representatives of the Sri Lankan banks participating in the program.

"Two field trips fortified subjects covered in class lectures and added an interesting sidenote to the program," Mr. Williams said. "The Central Agricultural Research Institute at Peradeniya, Sri Lanka, was the site for the first field trip. There the participants saw a demonstration on soil testing and heard a lecture on correlating soil tests with crops grown in the field. The group inspected rice plots that received different rates of nitrogen, phosphorus, and potassium. Rice plots that had only been transplanted 2 weeks were already showing a response to phosphorus fertilization."

The second field trip was to the Maho fertilizer warehousing complex to see fertilizer blending, packaging, handling, and storing facilities. There the marketing course trainees learned about the Maho training program for fertilizer dealers. En route to Maho a comparative analysis was made of private, government, and cooperative retail fertilizer dealers.

"The program closed on June 10 with an awards program for the teams giving the best presentations for the case studies," Mr. Williams said. "During the program, the participants had been grouped into teams for the purpose of solving hypothetical marketing problems."

The program was considered so successful that USAID, the Federal Republic of Germany, and the Sri Lanka Fertilizer Secretariat are planning to use this program as a model for future in-country fertilizer training courses. ■

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Nigeria—

IFDC Conducts First Regional Fertilizer Marketing Training Program for Africa

IFDC conducted its first regional Fertilizer Marketing Training Program for Africa at the University of Ibadan, Nigeria, August 2-13.

Cosponsored by the University of Ibadan, the program served 16 participants from 5 countries, including Sierra Leone, Swaziland, Nigeria, Upper Volta, and Sudan.

The program manager was Mr. L. B. Williams, IFDC Regional Coordinator for Africa; he was assisted by Dr. K. J. Byrnes, IFDC Sociologist, and Dr. Y. H. Chuang, Market Development Economist. Presentations were made by three former IFDC staff members: Dr. A. O. Falusi and Dr. J. A. Ekpere of the University of Ibadan and Dr. Olu Osiname of the University of Ife.

Dr. Falusi lectured on "Fertilizer Marketing in Nigeria" and "Fertilizer Legislation for Developing Countries." Dr. Ekpere lectured on "Extension Methods for Marketing" and "Effective Fertilizer Credit Programs." Dr. Osiname presented two papers: "The Essential Elements and Their Role in Plant Growth" and "Nutrient Requirements of Maize, Sorghum, and Millet."

Lectures were also presented by staff members of the International Institute of Tropical Agriculture (IITA). Dr. B. N. Okigbo, Deputy Director of IITA, spoke on farming systems for tropical agriculture. Dr. B. T. Kang, Agronomist, discussed soil fertility and nutritional problems for crop production in the tropics.

Two field trips added a practical aspect to the program. One trip was to IITA where Dr. P.L.G. Vlek, IFDC Visiting Soil Scientist, discussed IFDC's nitrogen program in west Africa. The group received an overview of IITA research programs. Of particular interest was the agricultural engineering activities where small equipment is being developed for tropical agriculture. The second field trip was to Oyo State to study the agroservice marketing system.

The theme of this training program was "Attacking the First Limiting Factor of a Marketing System." "By the end of the program the participants were aware of all of the components of a marketing system, and they understood the interrelationship of all of these elements," Mr. Williams said.

"They learned that if any of these elements is inadequate it becomes a limiting factor to the marketing system. The marketing chain is just as strong as the weakest link," Dr. Chuang said.

Case studies were used as a basis for applying the concepts taught throughout the program.

"The case studies generated considerable discussion on the best solution for problems given in the cases," Dr. Byrnes said.

During the closing ceremony, an award of recognition was presented to the team giving the best presentation on the final case study. Mr. Issa Martin Bikienga of Upper Volta won the Outstanding Male Participant Award and Ms. Ester Nsibandze of Swaziland won the Outstanding Female Participant Award.

The success of the course can be attested by the fact that two other African countries have already contacted IFDC to request country-specific programs. ■

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Participants and Faculty of the Regional Fertilizer Marketing Training Program. Front Row (from left): Dr. Y. H. Chuang, Mrs. K. A. Agbaje, Mr. L. B. Williams, Miss Ester Nsibandze, and Dr. K. J. Byrnes. Second Row (from left): Dr. A. O. Falusi, Mr. Gilbert D. Dada, Mr. Denis M. Kamara, Mr. Azeez A. Mustapha, Mr. B. I. Idowu, Mr. Adamu Godowoli, Mr. Martin Bikienga, Mr. K. M. Benisheikh, and Dr. J. A. Ekpere. Third Row (from left): Mr. S. M. Winsala, Mr. Bayo Oshoniyi, Mr. Olatunde Olanrewaju, Mr. James A. Sule, Mr. Chris O. Lufadeju, Mr. Carlos Cambron, and Mr. Mathanzima Z.K.M. Dlamini.

Philippines—

Third IFDC ^{15}N Training Course Held at IRRI

A special training course on ^{15}N techniques for nitrogen balance studies with rice—the third of its kind in IFDC history—was conducted at IRRI, June 7-28. IFDC has previously conducted similar courses at IFDC Headquarters with participants from Korea, India, Thailand, and the People's Republic of China.

Dr. I.R.P. Fillery, IFDC Soil Scientist based at IRRI, was manager of the course funded by the Australian Development Assistance Bureau (ADAB) and cosponsored by IFDC/IRRI. Dr. Fillery was assisted by Ir. Robbert Wetselaar, IFDC Soil Scientist, outposted to the Center for Soils Research, Bogor, Indonesia.

The purpose of the course was to train five Indonesian scientists in experimental, sampling, and analytical techniques involved in field research with ^{15}N on rice.

Like previous trainees, the Indonesian scientists will use this knowledge to conduct an experiment on a common design determined by collaborating scientists at a meeting held at IRRI in April 1979. The aim of the experiment is to determine plant recovery, losses, and immobilization in soil of different nitrogen fertilizer sources for rice. This cooperative research program is called the ^{15}N mini-network which is an outgrowth of the International Network on Soil Fertility and Fertilizer Evaluation for Rice (INSFFER), cosponsored by IRRI and IFDC.

The course met its objective, and the participants responded very well to the training, which involved not only laboratory work but also direct involvement in field activities.

In April 1983 a review and planning meeting of the mini-network will be held at the International Rice Research Conference at IRRI in Los Banos, Philippines. So far, data from five ^{15}N field experiments have been collected and will be summarized at the April 1983 meeting. ■

Upcoming Training Programs

Maintenance and Production Management Training for Fertilizer Producers; October 11-29; IFDC Headquarters; Mr. M. T. Frederick, Program Manager.

Regional Fertilizer Marketing Training Program for Asia; November 6-19; Cikampek, Indonesia; Dr. K. J. Byrnes, Program Manager.

Data Collection and Analysis for National Fertilizer Sector Studies; March 20-April 3, 1983; IFDC Headquarters and Washington, D.C.; Mr. G. T. Harris, Program Manager.

Contact IFDC's Training and Manpower Development Coordinator for more information on these programs.

Recent IFDC Publications

Energy and Fertilizer

Fertilizer is a major factor in increasing food production in the developing countries, but since 1971 a 10-fold increase in oil prices has increased farmers' costs for fertilizers by as much as four-fold.

Nitrogen fertilizers, especially urea, are the most popular and also the most energy intensive. The energy used to produce a 50-kg bag of urea is equal to 58 liters of gasoline. Although agricultural production uses only 3.5% of the world's total commercial energy, fertilizer production consumes 45.0% of agriculture's share.

However, improved efficiency in nitrogen fertilizer use and production can mean savings. Even though this report focuses on developing countries, policymakers, planners, and researchers dealing with different aspects of fertilizer planning in the industrialized nations will also find it useful.

In ordering this publication, please request Technical Bulletin T-20. The price is US $15 within the United States or US $20 for international addresses.

Potassium, Calcium, and Magnesium in the Tropics and Subtropics

Proper use of adequate amounts of potassium, calcium, and magnesium in fertilizers, soil amendments, crop residues and other byproducts, and minerals will be necessary if world crop production potentials are to be realized.

This report is intended to point out some of the complexities of the soil and fertilizer problems involving potassium, calcium, and magnesium. It is hoped that the information it contains will be helpful in the research, education, and development that will be required to point the way to increased food and crop production on soils of the tropics and subtropics throughout the world.

This report was prepared by Dr. Robert D. Munson, a former Consultant to IFDC. Dr. Munson is the North Central Director of the Potash and Phosphate Institute.

To order this publication, please request Technical Bulletin T-23. The price of the publication is $8 within the United States or $10 for international addresses.

Fertilizers for Tropical and Subtropical Agriculture

This paper, presented before the Fertiliser Society of London on March 12, 1981, as the Twelfth Francis New Memorial Lecture, focuses on fertilizers and fertilizer practices tailored to the crop, soil, climate, and socio-economic factors that prevail in the tropics and subtropics.

Dr. Donald L. McCune, Managing Director of IFDC, notes the increased use of fertilizer in these areas and the urgent need for increased efficiency and recovery of nutrients. He discusses the mechanisms of nitrogen loss and ways to overcome these losses, various possibilities for overcoming phosphate deficiencies, better use of indigenous resources, and the need to supply a balance of nutrients.

Please request Special Publication SP-2 in ordering this publication. The price of the publication is US $4.00 within the United States and US $7.50 for international addresses.

IFDC Report

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