IFDC

Report

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

Headquarters—

Mussoorie Rock Will Mean Millions in Savings

In a remote, hilly area of the state of Uttar Pradesh in northern India lies a large deposit of phosphate rock—one of the keys to unlock the door to increased food production. Indian farmers will be the ultimate beneficiaries of a project currently in progress at IFDC Headquarters, which is exploring ways to tap this valuable resource.

In January 1983, the United Nations Industrial Development Organization (UNIDO) contracted with IFDC on behalf of the Pyrites, Phosphates, and Chemicals, Ltd. (PPCL), a Government of India undertaking, to effectively use India's indigenous phosphate rock from the Mussoorie deposit. This deposit contains about 45 million tonnes of low-grade phosphate rock.

Mr. T. N. Jaggi, Chairman and Managing Director of PPCL, visited IFDC in late October to discuss the project's progress with IFDC officials. Mr. Jaggi is enthusiastic about the project's results to date and its potential impact on Indian agriculture.

"Millions of dollars in foreign exchange will be saved by using the indigenous fertilizer material," Mr. Jaggi said. "Using this local material becomes even more important when we consider that India is now placing restrictions on phosphate imports and also since consumption is increasing rapidly."

Mr. Jaggi sees Indian farmers as the direct recipients of this project. "Farmers should get the same agronomic results with the indigenous product as they are receiving from the more expensive imported product," Mr. Jaggi said.

A byproduct advantage of the project is that processing of the phosphate rock will generate additional employment in the country.

According to Mr. Jaggi the immediate objective of the project is to implement the research that is being conducted at IFDC by setting up a pilot plant in India. Then the material produced by this plant will be agronomically tested in India.

Dr. Amitava H. Roy, IFDC Chemical Engineer, is the technical coordinator of the project. Dr. S. H. (Norman) Chien, IFDC Research Chemist, (Soils), is supervising the laboratory soil incubation studies and Dr. L. L. Hammond, IFDC Soil Scientist, the greenhouse studies.

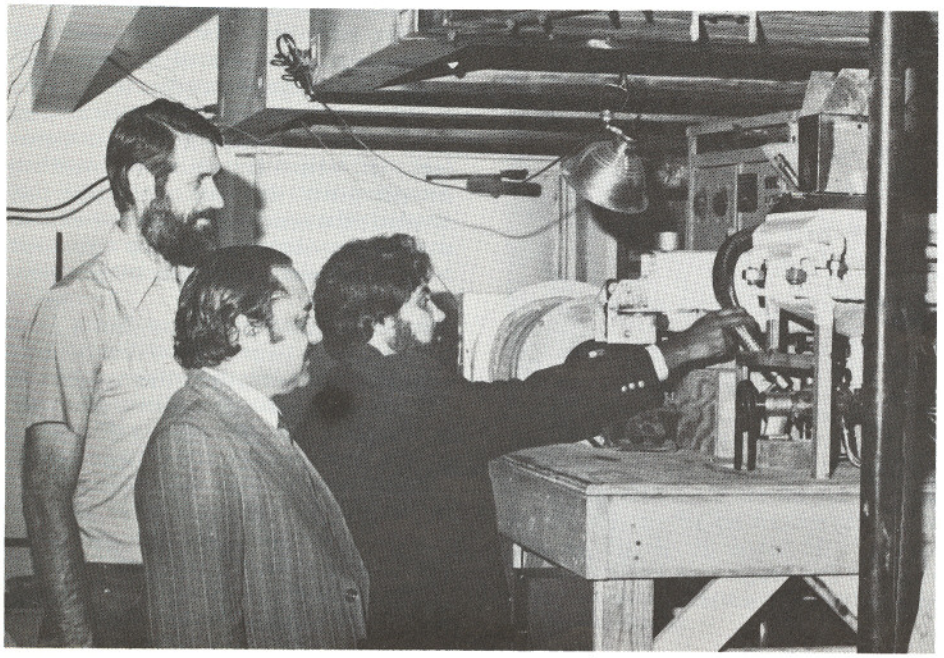
"The Mussoorie rock is being mined now and used as a direct application fertilizer in southern and eastern India," Dr. Roy said. "But a substantial amount of the powdered material is being lost during shipping and handling."

The IFDC researchers have shown that this problem can be eliminated through minigranulation of the fine rock. IFDC is now conducting the soil incubation studies and evaluating the minigranulated products in the greenhouse to determine their agronomic effectiveness.

"PPCL also wanted to produce a fertilizer that has some amount of water-soluble P_2O_5 to allow them to expand marketing to areas that are not suitable for direct application (near neutral soils)," Dr. Roy said. "Using an IFDC-developed process, partial acidulation/granulation, we have been able to produce a granular material, which is presently being evaluated in the laboratory and greenhouse."

The next major step in the project's progress is a demonstration of the processes scheduled for February 1984 at IFDC Headquarters. Indian engineers will come to IFDC for a 2-week period to observe the continuous operation of both processes. They will collect engineering data that will be used to set up the pilot plant in India.

"After the greenhouse studies have been completed, 100 kg of the promising products will be shipped to India for field trials in the potential consuming areas of northern and southeastern India," Dr. Roy said.



Mr. Marshall Goode, IFDC Technical Aide; Mr. T. N. Jaggi, Managing Director of PPCL; and Dr. Amitava H. Roy, IFDC Special Project Engineer, observe the operation of the bench-scale continuous granulation unit in IFDC's Pilot Plant.

In this issue...

Profiles of Visiting Scientists

Headquarters—

Marcel Tanke From DSM, The Netherlands, Brings Unique Insight To Solve Fertilizer Production Problems

"Marcel brings to IFDC an ideal blend of theoretical, practical, and commercial perspective for identifying and solving fertilizer production problems. By using his unique combination of talent, insight, and experience, we have strengthened our position in helping to improve plant production efficiencies which, in turn, will ultimately lead to least-cost fertilizer to the farmer—a cornerstone of our mission."

These words describing Mr. Marcel Tanke, IFDC Visiting Scientist and Special Project Engineer, are those of Mr. James J. Schultz, IFDC Engineering Coordinator.

Prior to arriving at IFDC in February 1982, Mr. Tanke worked at DSM in Geleen, the Netherlands. As a staff member of the Fertiliser Research Department, he was leader for the nitrophosphate project group.

"By using his (Tanke's) unique combination of talent, insight, and experience, we have strengthened our position in helping to improve plant production efficiencies which, in turn, will ultimately lead to least-cost fertilizer to the farmer—a cornerstone of our mission."—Schultz

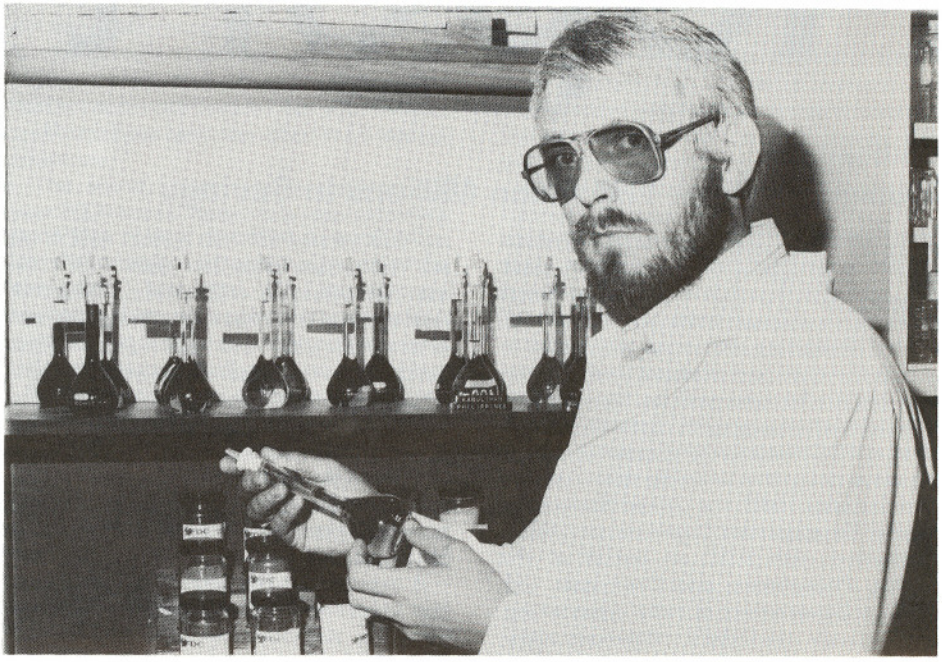
He also worked with an engineering subsidiary of DSM, Stamicarbon. For 4 months he was in Pakistan gathering data and "trouble shooting" in a fertilizer plant.

In preparation for his career, Mr. Tanke received B.S. and M.S. degrees in chemical engineering at Technical University, Twente, the Netherlands.

Through visits by his colleagues to IFDC, Mr. Tanke learned about the Center and its work. Several factors attracted him to IFDC.

"IFDC/TVA is the central point in the world for fertilizer communication," Mr. Tanke said. "I'm also here for training and to acquire published information that is not easily acquired in Europe."

During the past 1½ years Mr. Tanke has been working in IFDC's wet-process laboratory where he has tested phosphate rocks for phosphoric acid production. At the same time, he trained a group in nitrophosphate processing.



Mr. Marcel Tanke, Special Projects Engineer, inspects phosphoric acid samples in IFDC's wet-process phosphoric acid laboratory.

Now and for the next 1½ years, he will be working in IFDC's pilot plant where he will be involved in the granulation, acidulation, and beneficiation of phosphate rock.

". . . one may feel that his job is only a tiny bit when compared with the total results, but that tiny bit is the new part that he has contributed to the whole." —Tanke

An outstanding accomplishment already of Mr. Tanke's work has been the development of a computer program, called BALANCE, for the material balance calculation of phosphoric acid. He and Dr.W. Rex Clayton, IFDC Research Chemist, have also modified this program to include variable costs of flows of feed rates in the phosphoric acid plant to calculate variable costs of certain phosphate rocks in the phosphoric acid plant. This new COST program has proven to be very valuable for making preliminary cost estimates. The two-man team rewrote the program so that it could be used on a small pocket computer.

When asked about the rewarding aspect of his job, Mr. Tanke replied, "Working in an international organization that is dedicated to ensuring that fertilizer is not the limiting factor of world food production, one may feel that his job is only a tiny bit when compared with the total results, but that tiny bit is the new part that he has contributed to the whole. In the long run, it will have its influence toward helping achieve the goal."

It is obvious that Marcel Tanke finds satisfaction in helping solve problems for people. Whether it is determining the value of a rock or developing a new computer program, he brings to each situation a unique talent, insight, and experience.

Headquarters—

Wayne M. Strong From Queensland Wheat Research Institute Plays Role in Major IFDC Breakthrough

Dr. Wayne M. Strong's enthusiasm and dedicated attitude are sources of inspiration for his coworkers.

One of these coworkers, Dr. Roland Buresh, IFDC Soil Scientist, had this to say about Dr. Strong. "In addition to conducting rather novel research on the measurement of denitrification, Wayne has brought new ideas and insights to ongoing research at IFDC. His enthusiasm has carried over to others and made working with him interesting and exciting."

Before he came to IFDC in August 1983 as a Visiting Scientist, Dr. Strong worked as an agronomist at the Queensland Wheat Research Institute, Toowoomba, Australia. During the past decade, his chief area of research has been the nitrogen and phosphate fertilizer requirements of grain crops. He was responsible for fertilizer research in most of the major grain-growing regions, including Darling Downs and the more remote regions of western and central Queensland. Part of his work has resulted in the establishment of guidelines for fertilizer recommendations for cereal crops in Queensland.

The road toward Dr. Strong's agronomy career was first paved with degrees in soil science—first with a Bachelor of Agricultural Science, with honors, from the University of Queensland, Australia, in 1965 and later with a Ph.D. degree in Soil Science from the University of Manitoba, Canada, in 1970.

Dr. Strong has known about IFDC since its inception through a former colleague at the Queensland Wheat Research Institute, Dr. Eric T. Craswell (former IFDC Soil Scientist).

The major factor contributing to his attraction to IFDC was its stature in the fertilizer field. In his words, "As a research establishment, IFDC is approaching maturity, and the research emanating from IFDC is displaying that maturity. At IFDC the chances of undertaking very good research, particularly with nitrogen, are very good. It is a worthwhile place to embark on that research."

As a member of the nitrogen research team at IFDC, Dr. Strong is involved in developing methodology suited to studies of denitrification (a reduction process in the soil where the soil nitrogen is reduced to nitrogen gas).

His excitement about a recent breakthrough in this research is contagious. "This development is the brain wave of Dr. Eric T. Craswell," Dr. Strong said. "Until now we really haven't known the importance of the loss mechanism because we've always studied it indirectly. We've always assumed that what we cannot find (at some time in the future) of that fertilizer we apply has been lost through various processes."

The new methodology allows the research team, consisting of Dr. E. R. Austin, Instrumentation Specialist; Dr. Roland Buresh, Soil Scientist; Mr. B. H. Byrnes, Research Associate; and Mrs. Leela S. Holt, Chemical Laboratory Analyst, to measure nitrogen losses directly. It allows them to take a sample of gas evolving from the soil, measure its isotopic abundance, and state whether or not that has been derived from the fertilizer source.

"We haven't known until now how small a gas sample we could use to get a precise measurement of its isotopic composition," Dr. Strong said. "We now know that we can use relatively small samples and still get an accurate analysis."

Prior to this breakthrough, studies of gaseous composition of the soil atmosphere have been limited to those gases that can be measured using established procedures.

"This is an entirely new avenue of studying nitrogen transformation involving gas. And it is IFDC's brain child, an original IFDC finding."
—Strong

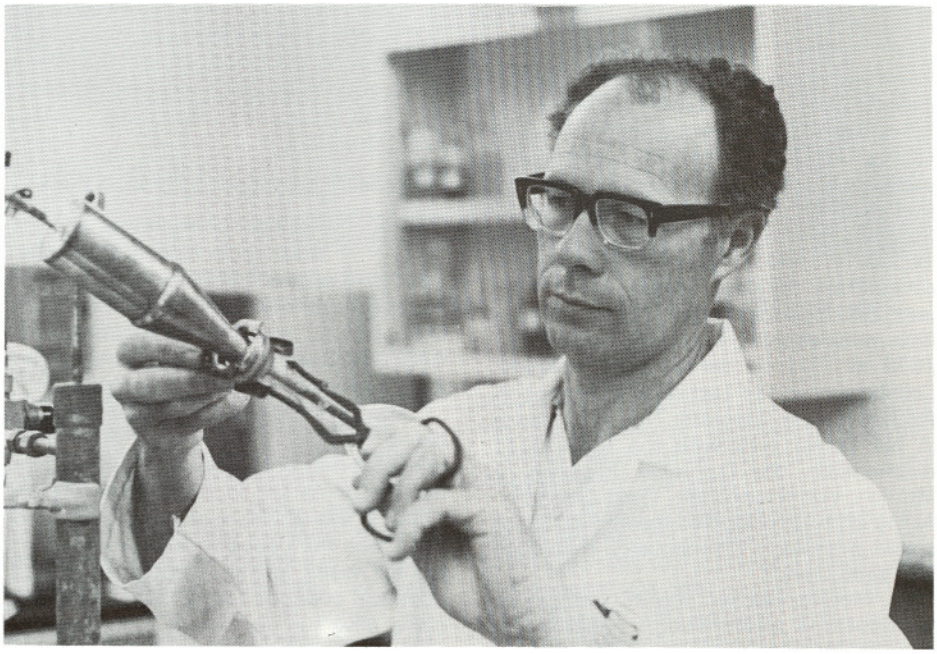
The new methodology enables the scientists to measure the isotopic composition of nitrogen gas, which is the most important product of nitrate reduction in soil and so they can determine fertilizer losses.

Using what Dr. Craswell labeled the "arc process," the researchers apply an electric discharge in a closed system of gases. The gases are converted to oxides; the oxides are absorbed into a solution; and the solution's isotopic composition can then be measured using a mass spectrometer.

"This is an entirely new avenue of studying nitrogen transformation involving gas," Dr. Strong said. "And it is IFDC's brain child, an original IFDC finding."

Dr. Strong has high aspirations for the future of this research. "We hope to advance this methodology for studying denitrification and soil atmospheric gases to a stage where we can use it with confidence under field conditions. To date most research in this area has been conducted under closely controlled laboratory or growth-chamber studies. We think that the methodology will be appropriate for use under field conditions. Then we'll be making a direct measurement of denitrification."

For Wayne Strong reward that comes from working at an institution like IFDC is derived through achievement. "Since we work with scientists from a wide range of disciplines, we have a much better chance of achieving success at IFDC," Dr. Strong said.



Dr. W. M. Strong, Visiting Scientist, prepares ^{15}N samples for isotopic enrichment analysis on the mass spectrometer.

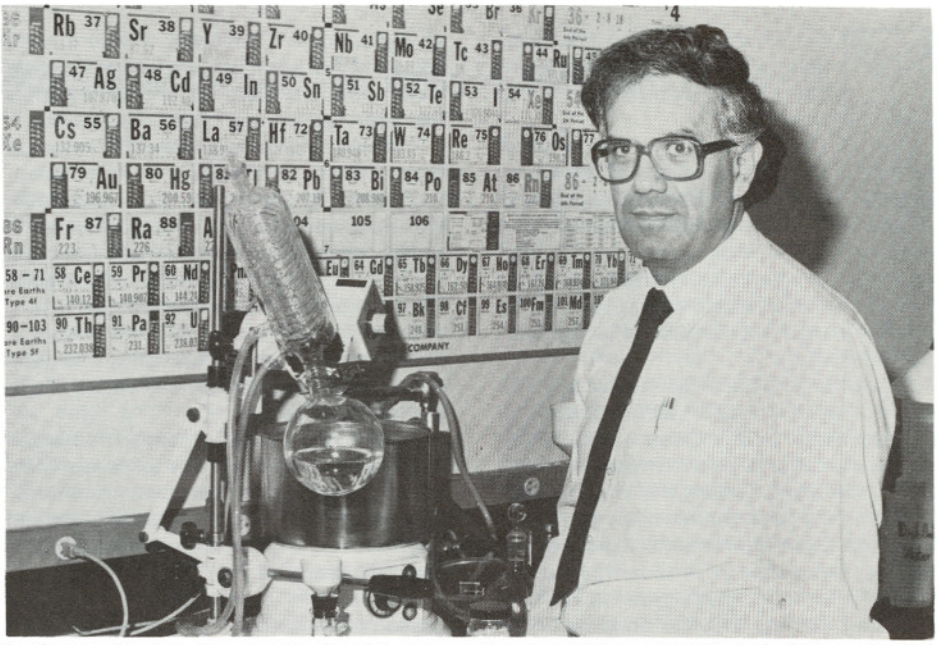
Headquarters—

Ramiro Medina From the Technical University of Munich Strives to Produce an Effective Urease Inhibitor

Rice farmers of the developing world may very well be the beneficiaries of research on urease inhibitors that is now being conducted at IFDC by an enzyme biochemist from the Technical University of Munich. If Dr. Ramiro Medina is successful in producing an effective inhibitor, as much as 60% savings in fertilizer nitrogen could result.

His collaborators on this project believe in his abilities. As Dr. N. K. Savant, IFDC Soil Chemist, puts it, "Because of a strong background in enzyme biochemistry and a long research experience, Dr. Medina may very well give rice agronomists a more effective urease inhibitor, which will help decrease ammonia volatilization losses of broadcast urea in wetland rice fields."

Born in La Paz, Bolivia, Dr. Medina traveled to West Germany to receive his higher education at the Technical University of Munich where he attained a B.S. degree in chemistry in 1964 and a Ph.D. degree in biochemistry in 1966.



Dr. Ramiro Medina, Enzyme Biochemist, prepares to use a rotary evaporator to isolate a potential urease inhibitor in the IFDC synthesis laboratory.

". . . Dr. Medina may very well give rice agronomists a more effective urease inhibitor, which will help decrease ammonia volatilization losses of broadcast urea in wetland rice fields."
—Savant

Returning to his homeland in 1967, he became Director of the Chemistry Department, Universidad Mayor de San Andres in La Paz. In 1970 he became Head of the Basic Research Department, Mining and Metallurgical Research Institut, Oruro, Bolivia. For the next 3 years his work focused on developing new methodology to concentrate minerals, especially tin. His team developed new organic compounds to float minerals and concentrate them. From 1973 to 1974 he served as a Scientific Collaborator at the Technical University of Aachen in West Germany. The next venture in his career was with the Institute of Biochemistry, the Technical University of Munich, Weihenstephan, West Germany. At the Insitute he studied the application of stable isotopes in biochemistry, medicine, and agriculture.

Dr. Medina learned of IFDC through its publications and through cooperative research with the Institute of Plant Nutrition with which Dr. Anton Amberger, a member of IFDC's Board of Directors, is affiliated.

At IFDC Dr. Medina is conducting research to control the urease reaction by preventing ammonia losses through the use of inhibitors.

"Urease is the enzyme responsible for the breakdown of the urea molecule to produce ammonia and carbon dioxide," Dr. Medina said. "Losses of fertilizer nitrogen through this urease reaction could be as high as 60%. If we can control the activity of the enzyme urease, then we can control losses of ammonia. We must try to prepare inhibitors that are more stable and cheaper and will be effective 3-6 weeks."

Dr. Medina finds his work interesting for two basic reasons. First of all, as he says, "research work is creative work; you have a problem and can solve it by developing new technology and compounds."

Another aspect of his work that brings him much satisfaction is working in interdisciplinary groups. "Because there is only one solution to a difficult problem, it must be found through teamwork—many specialists working together," Dr. Medina said.

Bangladesh—

Broken Language Barrier "Makes the Most of a Miracle"

A Bengali translation of the film, "Making the Most of a Miracle," originally produced by The Fertilizer Institute (TFI) of Washington, D.C., U.S.A., and later translated with BADC/IFDC assistance, is receiving acclaim from audiences throughout Bangladesh.

"Making the Most of a Miracle" is a film based on plant growth, crop production, and plant nutrients. It deals mainly with the miracle of nature in plant growth, plant nutrient availability, and the synthesis of plant food from substances available from the soil, water, and air. Through animation, chemical changes taking place in the soil come alive for the viewer. Complex processes become simple. Capitalizing on the sense of sight and sound, the film clarifies processes such as translocation, transpiration, and evaporation stomato technology of plant growth.

"The message of the film is universal, easy to understand, and effective both as a technical and as a promotional film."—Bari

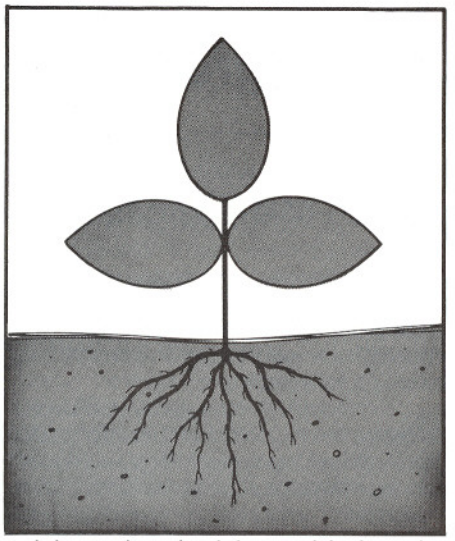
The film discusses the 16 essential nutrients that must be provided for good crop growth. The need to replenish the soil with

nutrients by applying fertilizer is portrayed as an absolute requirement of successful crop production. The importance of balanced fertilization is also shown as a very important feature of plant growth.

The original idea for using the film in Bangladesh training programs came from Mr. M.I.M. Howlader, Former General Manager (Supply), Bangladesh Agricultural Development Corporation (BADC). While he was attending a fertilizer marketing training program at IFDC Headquarters during 1981, Mr. Howlader viewed the English version of the film as part of the program.

Mr. Howlader asked IFDC to explore the possibility of acquiring a copy of the film to be taken to Bangladesh for use in training programs. Accordingly, a copy of the film was provided by TFI.

In early 1982 the English version of the film was shown during the first BADC Dealer Training Program. The film was also shown at various places in Bangladesh during all phases of training, including staff



training, trainers' training, and dealer training. Students and teachers at the Bangladesh Agricultural University, Mymensingh, also viewed the film.

Observing the film's impact, BADC management decided to translate it into Bengali. They requested IFDC to arrange for the Bengali narration to be dubbed over the English version.

At the end of a 4-week individual training program in which he was participating at IFDC Headquarters, Mr. A.H.M. Obaidul Bari, BADC Manager of Dealer Development and Training, visited the original producer of the film in New York, New York, U.S.A., to narrate the script in Bengali.

Since Mr. Bari carried the Bengali version of the film to Bangladesh in May 1983, it has been shown to various audiences including BADC marketing personnel during IFDC's in-country training program; agricultural research workers; students; and BADC officials, executives, and field officers.

In a recent letter to IFDC, Mr. Bari related the success of the Bengali version. "The message of the film is universal, easy to understand, and effective both as a technical and as a promotional film," Mr. Bari writes.

Venezuela—

IFDC Evaluates Physical Quality of PALMAVEN Fertilizer Inventory

At the request of PEQUIVEN/PALMAVEN, two IFDC fertilizer technologists conducted onsite studies of stored fertilizer in 17 Venezuelan sales zones to determine its physical condition and value from October 13 to November 12.

Mr. Jorge R. Polo, an IFDC Chemical Engineer and Deputy Engineering Coordinator, and Mr. David W. Rutland, Chemical Laboratory Analyst, specializing in fertilizer quality control, visited 75 warehouses throughout Venezuela.

PALMAVEN, a government-owned fertilizer marketing organization, presently has an inventory of about 320,000 tonnes of straight and complex fertilizers distributed in the 17 sales zones. The fertilizer is stored in bags and stacked in piles up to 25 layers high. Because of a lower demand for particular grades, some of the material has been stored as long as 4 years.

The objectives of this technical assistance mission were to estimate the quantity of the inventory, determine the value of the products in each sales zone, and recommend conditions to be established by PALMAVEN to minimize damage of product during storage.

"We first visited the PEQUIVEN fertilizer complex at Moron to observe the fertilizer processes and methods employed in manufacturing, handling, and bagging the various NPK and straight fertilizer grades," Mr. Polo said. "We took samples of each fertilizer grade to use as a reference for visual comparisons with the products in the warehouses. We then visited the warehouses throughout Venezuela to inspect the inventory."

The team conducted onsite physical properties tests to verify the physical condition

Mr. David Rutland, IFDC Chemical Laboratory Analyst, and Sr. Francisco Sanchez, PALMAVEN Representative, Barquisimeto zone, inspect bagged fertilizer to determine its degree of caking.

of the material. They looked for such conditions as caking, moisture retention, etc.

"Approximately one-half of the material was found to be in excellent condition," Mr. Polo said. "Only 1% of the material was found to be in very bad condition; this is a very low percentage of undesirable product."

The remainder of the material has some degree of caking, thus this portion will require a price reduction in order to be sold.

"PALMAVEN has two alternatives—either to reprocess the undesirable material and sell at the normal price or lower the price and sell at a discount to compensate for the lower physical quality," Mr. Polo said. "They chose to lower the price."

The IFDC team developed a pricing schedule for PALMAVEN to use in determining the price according to the physical condition of the material. On their return to IFDC, the team brought 150 samples of the stored fertilizer on which chemical analyses will be conducted.

Training Program Activities

Headquarters—

Fourth Maintenance and Production Management Training Program Provides Practical Applications

Providing practical solutions to existing problems in fertilizer plants always makes the Maintenance and Production Management Training Program a valuable experience for its participants. The fourth such program held at Headquarters, October 3-21, continued to fulfill this expectation.

Eighteen fertilizer plant personnel from 11 countries attended the program that consisted of 2 weeks of classroom activities and a 1-week field trip to the Florida phosphate industry. Countries represented included Colombia, Egypt, India, Indonesia, Korea, Malaysia, Peru, Saudi Arabia, Tanzania, Thailand, and Venezuela.

Mr. M. T. Frederick, IFDC Chemical Engineer, was the program manager. The other leaders of the program were recruited from major international- and U.S.-based fertilizer-related organizations.

The first week of course work began with an overview of fertilizer sector highlights such as fertilizer supply and demand, production economics, and fertilizer production technology and research activities. This overview and a review of basic management principles provided the participants a broad perspective of the fertilizer industry and prepared them for an intensive 3-day short-course dealing with maintenance management. Key elements of the maintenance management shortcourse included organization and staffing, recordkeeping and control, planning and scheduling, appraisal of performance, budgeting, and training.

"Also, exchanging ideas with the other members of the group was very helpful; they have problems similar to mine and some of them promised to send me information on solutions to these problems." —Camacho

Industrial experience provided the foundation for the second week of course work. Lecture/discussion sessions were organized for an in-depth treatment of topics such as organization and staffing of maintenance and production departments, planning and scheduling, inventory control, documentation, training, and employee motivation and safety.

A project planning and scheduling workshop gave each person an opportunity to engage in developing an implementation schedule for selected hypothetical maintenance and production projects.

During the third week of the program, the group visited several fertilizer production and maintenance support facilities, including the International Minerals and Chemical Co. (IMC) and Royster Chemical Co. near Lakeland, Florida, U.S.A. This firsthand view of the industry allowed time for discussions of maintenance and production management problems with plant management and technical staff.

At the conclusion of the course, two of the participants, Mr. Carlos Camacho Benner, Mechanical Engineer, PETROPERU, Talara, Peru, and Mr. Hoe S. Kwon, Manager of Marketing and Procurement, Kyunggi Chemicals, Ltd., Seoul, Korea, shared their impressions of the program.

"The information on computer systems to improve maintenance organization was the most enlightening aspect of the program for me," Mr. Camacho said. "Also, exchanging ideas with the other members of the group was very helpful; they have problems similar to mine and some of them promised to send me information on solutions to these problems."

Mr. Camacho revealed that one problem that he encounters involves a centrifugal compressor in an ammonia plant at his company.

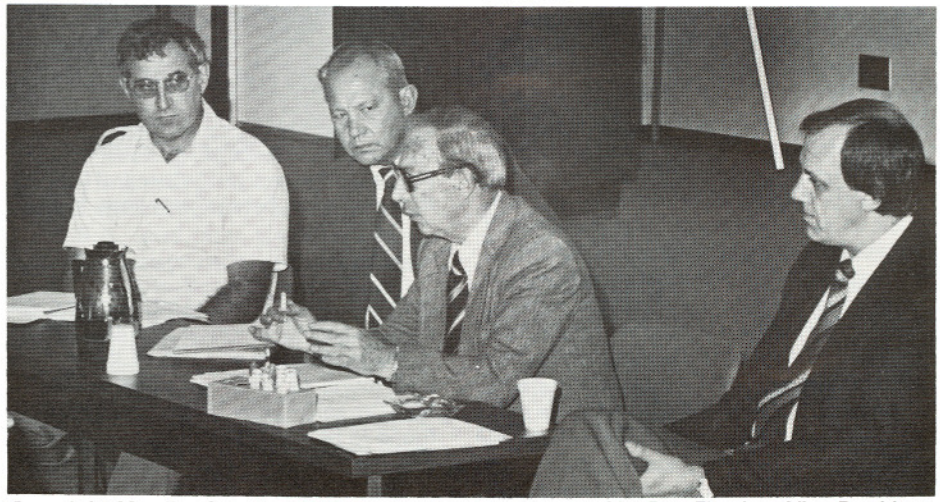
"Using this type of compressor, we must lubricate the bearings every 2½ hours to maintain a constant level of oil," Mr. Camacho said. "During this program I learned of other types of compressors that we can convert to."

Mr. Kwon learned of fertilizer production processes that are new to him. These include making phosphoric acid using hydrochloric acid and compaction processes for potassium sulfate. Since his company is considering the implementation of these particular processes, he gained information that will have practical application in his situation.

Another valuable aspect of the program for Mr. Kwon was the interaction with other participants.

"Discussions with the other people confirmed my opinion that it would be more economical for my country to import urea than to produce it; in fact, we could buy it for almost one-half as much as it is costing us to produce," Mr. Kwon said. "In my country the price of energy is very high. Still we're producing nitrogen fertilizer from naphtha. Participants from Indonesia and Saudi Arabia told me that they are producing urea at half of our cost."

Mr. Kwon also expressed amazement over the wealth of printed materials available at both IFDC and the Tennessee Valley Authority (TVA). He encouraged IFDC officials to inform prospective training program participants of the availability of a wide variety of fertilizer publications at the IFDC and TVA libraries.



(From left) Mr. Jim Schultz, IFDC Engineering Coordinator; Mr. Ray Fleming, Vice President, Engineering, Sigma Services, Inc., Plant City, Florida, U.S.A.; Mr. Adolfo Sisto, General Manager, Industrial Operations, FERTIMEX, Mexico; and Dr. Keith Farmery, President, Katalco Corporation, Chicago, Illinois, U.S.A. lead a panel discussion on "Developing a Dynamic System for Maintenance" during the Maintenance and Production Management Training Program.

Headquarters—

Seventh Annual FMMTP Strives to Prepare Marketing Managers

According to the philosophy of the seventh annual Fertilizer Marketing Management Training Program, the goal of a fertilizer marketing organization is to satisfy the consumer (farmer) while, at the same time, effectively achieving the organization's objectives. This requires a team of managers who are skilled in all aspects of marketing fertilizers in today's changing world.

After completing this seventh annual program held at IFDC Headquarters on August 15-September 23, 28 marketing managers from 16 countries are better able to achieve this goal. To gain this training, the participants came from Bangladesh, Colombia, Commonwealth Marianas, Dominican Republic, Egypt, Gambia, India, Indonesia, Israel, Jordan, Nepal, Nigeria, Pakistan, Republic of China, Sierra Leone, and Zambia.

This program, under the direction of Mr. Lewis B. Williams, IFDC Regional Coordinator—Africa, focused on integrated marketing concepts, market planning, and marketing systems development.

The 6-week program, consisting of classroom activities and field trips, was presented by a core of IFDC experts with support from selected specialists from the National Fertilizer Development Center of TVA, U.S. universities, the fertilizer industry, and international fertilizer organizations. During the program the participants were involved in a wide range of training activities including lectures, films, simulation exercises, case studies, discussions, and field trips.

Specific topics covered focused on the elements of marketing and their functions; world fertilizer situation; modern marketing concepts; factors influencing marketing decisions, including government policy, fertilizer product characteristics, product packaging and handling; price factors, including international price trends, marketing margins, and credit; agronomic use of fertilizer products; and the agro-service concept of fertilizer marketing.

Field trips to the U.S. Corn Belt and to the phosphate-producing area of Florida provided an opportunity to observe and study private-sector fertilizer factories, warehouses, and transportation systems; research in progress; local dealers; and farms. Fertilizer marketing as accomplished by the U.S. cooperatives was studied in the Corn Belt.

Three of the participants summarized their reactions to the program during an interview at its conclusion. They were Mr. Hani H. Khoury, Marketing Manager, Jordan Fertilizer Industry Co., Ltd., Amman, Jordan; Ms. Sylvia C.Y. Lee, Senior Specialist, Council for Agricultural Planning and Development, Taipei, Taiwan; and Mr. Antonio S. Palacios, Agriculture Extension Agent, Department of Natural Resources, Saipan, Commonwealth Marianas.

Mr. Khoury and Mr. Palacios both found the session on market research, presented by Dr. Gerald Crawford, Professor of Marketing, University of North Alabama, to be most enlightening. Mr. Palacios expressed his belief that he could apply what he learned on this subject to his work in Saipan.

"Marketing vegetable crops presents one of our most difficult problems in Saipan," Mr. Palacios said. "Backyard gardening is quite prevalent, thus overproduction results. Farmers sometimes sell at a very low price just to try to recover some of the costs. After completing this program, I can now advise the farmers how they can grow their crops and market them to get the best price."

Ms. Lee found the program helpful in that she sees many ways that the information can be applied to solve some of her problems in Taiwan.

"The information on pricing policies, fertilizer policy options and implications, and warehouse management and inventory control will help me to reduce the costs of fertilizer in my country," Ms. Lee said. Ms. Lee also found the sessions on quality control and international fertilizer information sources to be very interesting.

In addition, the participants gave their opinion on how the program could be improved to contribute even more toward achieving the goal of developing a cadre of skilled fertilizer marketing management personnel.

Mr. Lewis B. Williams, FMMTP Program Manager, assists program participants, Mr. Hani H. Khoury (Jordan); Ms. Sylvia C.Y. Lee (Taiwan); and Mr. Antonio S. Palacios (Commonwealth Marianas) in solving a marketing problem.

UPCOMING TRAINING PROGRAMS

Fertilizer Distribution and Handling Training Program; India, Singapore, and Indonesia; February 20-March 9.

Ammonia/Urea Plant Operations Workshop; New Orleans, Louisiana (U.S.A.); April 7-18.

Fertilizer Efficiency Research in the Tropics—Latin America (in Spanish); Colombia; May 7-25.

Fertilizer Production Economics Process Training Program; IFDC; May 14-25.

Fertilizer Efficiency Research and Technology Transfer Workshop; IFDC; June 14-July 3.

Recent IFDC Publications

Fertilizer Sulfur and Food Production: Research and Policy Implications for Tropical Countries (Executive Brief)

This study deals with the economic importance of sulfur in the fertilizer industry, food production, and the agricultural sector in the tropical countries of Asia, Africa, and Latin America. It provides guidelines for future directions in fertilizer sulfur research and public policy. Even though the primary focus is on the tropical countries, the study is expected to be useful for fertilizer researchers, extension agents, manufacturers, distributors, planners, and policymakers around the world.

The study analyzes sulfur deficiency as a constraint to food production. It also estimates aggregate fertilizer sulfur requirements, supplies, and implied gaps between the two in selected tropical countries and regions from 1960 to 2000. Past performance, the current economic situation, and future outlook are examined with respect to sulfur demand, supply, prices, resources, and trade. Alternative fertilizer sulfur strategies are evaluated in the context of indigenous sulfur research and public policy.

Sulfur is one of the major plant nutrients. It rivals nitrogen in protein synthesis and phosphorus in uptake by crops. Yet its importance in tropical agriculture has still not been fully recognized. Sulfur deficiency is widespread and growing, adversely affecting input productivity, crop production, and human nutrition. Serious sulfur deficiency problems have been identified in 46 tropical countries.

The world sulfur requirements in the year 2000 are estimated to be approximately 50 million tonnes of sulfur as crop nutrient and 65 million tonnes of sulfur for the fertilizer industry. The projected fertilizer sulfur gaps are estimated to be large and widening. Unless something is done to bridge these gaps, national and international efforts to accelerate food production will be seriously handicapped.

In order to deal with increasing sulfur gaps, there is a need to identify, develop, evaluate, and transfer economically efficient fertilizer technology and strategies appropriate for tropical countries. Since most of the tropical countries are net importers of sulfur, alternative sulfur supply strategies must emphasize the use of indigenous sources such as gypsum, phosphogypsum, and pyrites.

The national governments must take a lead in promoting balanced nutrient use and efficient public policies that encourage the production, imports, distribution, and use of sulfur-containing fertilizers.

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