

Report

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

Zimbabwe—

IFDC Team Makes Appraisal of Fertilizer Sector



At the request of the Industrial Development Corporation of Zimbabwe, an IFDC team visited

Zimbabwe during June 5-15 to have a firsthand look at the country's fertilizer industry and to make a preliminary appraisal of some of their alternatives. The team included: Dr. Donald L. McCune, Managing Director of IFDC; Mr. Owen W. Livingston, Director of the Fertilizer Technology Division; and Mr. John M. Hill, Marketing Development Specialist in the Outreach Division.

Agriculture in Zimbabwe is divided into two distinct groups—commercial agriculture and tribal trust lands (TTLs). Commercial agriculture, comprising 5,200 commercial farms in 1981, produced about 80% of the 1980 agricultural production. Small-scale farmers, almost wholly in the TTLs, total about 850,000 and produce 20% of the agricultural production. The TTLs are almost totally in the low rainfall areas and have a rapidly growing population, extremely low input levels, extremely low production levels, and a disproportionately poor share of Zimbabwe's infrastructure.

A large percentage of land, both in the commercial and in the TTL sectors, is not being used fully. If irrigation could be introduced into the lower rainfall areas, the country's agriculture could support a significantly larger population. However, Zimbabwe is one of the few countries in Africa that is currently able not only to feed itself but also to produce crops for export.



During a visit to the Seke tribal trust land (TTL), Dr. Donald L. McCune, IFDC Managing Director, holds the daughter of a TTL farmer.

The soils of the country produce a wide variety of high-yielding crops. Of the current population of about 7.4 million, 75% derive their livelihood directly or indirectly from agriculture.

The IFDC team visited Seke TTL, about 48 kilometers south of Salisbury, where the team met with Chief Seke and nine saving clubs, which were each composed of 8-25 farmers. A saving club is a group of people who band together and save money with which to buy fertilizer.

The team also visited five commercial farms, one of which was a Tilcor estate in a TTL in the Lowveld, and a large sugar estate that also processes raw sugar. Commercial farmers are well served by the two fertilizer companies in Zimbabwe. The commercial farms are well managed and use the latest varieties, cultural practices, and technology. The yields of these farms for many crops are equal to

or higher than those in many developed countries.

With the rapid expansion of the agricultural industry, fertilizer consumption has been outstripping production facilities. Zimbabwe has been self-sufficient in superphosphate manufacture for 25 years and for the past 15 years has also produced ammonium nitrate.

During 1980/81 fertilizer consumption in Zimbabwe is expected to total about 500,000 product tons or

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163,000 nutrient tons. Because of a shortage of local production capacity, fertilizer imports in 1981 are estimated to equal one-half of the total fertilizer nutrient used. As the agricultural industry expands, the proportion of imported fertilizer will become larger unless a major investment program to expand local fertilizer production is instituted.

All fertilizers are sold to farmers at the factory gate. Currently neither distributors nor dealers exist to warehouse any

fertilizers. Small quantities for home gardeners are available in certain retail outlets. Farmers are expected to buy in advance of need and do their own warehousing. Cooperatives act as financiers of fertilizer purchases for member farmers.

The team offered several suggestions for developing a long-range fertilizer sector plan, which complements the country's agricultural plan. Meanwhile, several interim projects of low-capital outlay were suggested. ■

In the next issue. . .

N Project in West Africa
African Fertilizer Center
Training Programs in Thailand,
Nigeria, Bahamas, and
Headquarters

have learned ways of increasing available P_2O_5 , reducing pollution, using ammonia and phosphoric acid in granulation plants, and producing fluid fertilizers."

As a result of the IFDC assistance, CEFER itself is now better prepared to extend assistance to the Brazilian industries. Some specific technology that CEFER is now prepared to transfer to these industries includes: (1) conducting geological, mineralogical, and chemical characterizations of phosphate rock, (2) using Brazilian phosphate rock in the production of single superphosphate (SSP) and triple superphosphate (TSP), (3) examining the behavior of Brazilian rock in phosphoric acid plants, (4) designing and operating granulation plants, (5) developing thermal treatments of phosphate rock, (6) training industry people in pilot-plant granulation, and (7) recovering waste material to be used as fertilizer.

The IFDC Technical Training/ Assistance Coordinator, Mr. J. J. Schultz, recognized the reciprocal benefits that IFDC has derived from working with CEFER:

"We now have an improved knowledge of Brazil's agricultural input needs. In the process of IFDC's presenting technical training seminars, our ability to conduct such programs has improved, and we have learned more about the practical problems of training and technical assistance. IFDC personnel have developed a rapport with Brazil's fertilizer industries."

After the completion of the technical assistance agreement in 1982, Dr. Marinelli expects to call on IFDC for assistance again.

"We will need IFDC's assistance in training in specific areas with well-defined objectives," Dr. Marinelli said. ■

Headquarters—

IFDC Outlines Fifth-Semester Plan of Technical Assistance to CEFER



"IFDC technical assistance to the Centro de Estudos de Fertilizantes (CEFER) in São Paulo, Brazil, since

1978, has been very helpful to Brazilian fertilizer technologists and has resulted in the application of improved methodology and technology. The changes are designed to increase the consumption of fertilizer and ensure the proper use of fertilizer."

This was the consensus expressed by two CEFER officials, Dr. Oswaldo Marinelli, Director, and Mr. Ivan Dutra, Director of Technical Group, when they visited IFDC Headquarters during June 20-24. The purpose of the visit was

to discuss with IFDC personnel the plans for the fifth and final semester of IFDC assistance scheduled to begin in September.

IFDC has provided technical assistance to Brazilian fertilizer industries also. They include: Companhia Petroquímica Brasileira (COPEBRAS); Industria y Comercio de Fertilizantes (ULTRA-FERTIL); Fosfatos de Goiás, S.A. (FOSFAGO); MANAH S.A.; Companhia Paulista de Fertilizantes (COPAS); and Solorrico Fertilizantes União, S.A.

Assessing the results of IFDC assistance to Brazilian fertilizer industries to date, Dr. Marinelli had this to say: "They



CEFER Director, Dr. Oswaldo Marinelli (on the left); Dr. Amit Roy, IFDC Chemical Engineer; Mr. Ivan Dutra, CEFER Director of Technical Group; and Mr. Jorge Polo, IFDC Chemical Engineer, inspect some partially acidulated phosphate rock, being developed in the IFDC laboratory-scale pilot plant.

Ecuador—

Fertilizer Supply Study Conducted for FERTISA



IFDC scientists completed in July a fertilizer supply study for the Fertilizantes Ecuatorianos, S.A. (FERTISA) of Guayaquil, Ecuador. During March 23-April 1, Mr. Frank A. Little, IFDC Industrial Project Analyst, and Dr. Adolfo Martinez, IFDC Fertilizer-Use Economist, collected the necessary data for the study in Ecuador.

The general objective of the study was to develop a preliminary economic analysis of selected fertilizer supply alternatives to enable FERTISA to meet projected sales requirements. The following specific items were covered by the study: (1) preliminary investment and production cost estimates for a new sulfuric acid plant, (2) development and assessment of cost estimates for main-

tenance/modification projects for existing FERTISA manufacturing facilities through 1985, and (3) assessment of the utilization of existing facilities under a bulk-blend NPK fertilizer supply alternative.

Nutrient consumption in Ecuador has increased from 15,000 tons in 1965 to about 80,000 tons in 1980. FERTISA's objective is to have supply capability to meet the total NPK compound fertilizer demand and 50% of the straight fertilizer demand.

The IFDC study team prepared a preliminary economic analysis for three supply alternatives which would enable FERTISA to meet projected sales requirements. Alternative I consisted of a bulk-blending and bagging facility at the Guayaquil complex. Alternative II was a

similar facility at the New Site complex, whereas Alternative III was a new DAP/NPK granulation plant and phosphoric acid receiving and storage terminal at the Guayaquil complex.

Even though emphasis in the comparative economic analysis was on the manufacture of NPK compound fertilizers, it was necessary to consider the supply of straight fertilizer materials to properly compare the supply alternatives.

In the IFDC report to FERTISA, the three alternatives are evaluated. The study also outlines recommendations for the implementation of the preferred supply alternative. In addition, suggestions were made for minimizing caking and material segregation, the two most common problems in bulk-blending and bagging operations. ■

Sri Lanka—

IFDC Plan Will Increase Coconut Production



The king coconut could be "king" again in Sri Lanka with the help of IFDC researchers.

If the Sri Lanka Ministry of Coconut Industries follows a plan developed by IFDC agricultural economist, Mr. Lewis B. Williams, the increase in coconut production will feed the 1.7% increase in Sri Lanka population during the next 5 years. An annual per capita consumption of 130 nuts will be provided plus a surplus of 55 million nuts for export.

Sri Lanka's coconut production has been declining in recent years, and the 1981 harvest is expected to be slightly below 2 billion nuts. This downward trend becomes alarming when examined in relation to the country's annual per capita requirement of 130 nuts, coupled with its increasing population and the country's dependence on coconuts for export.



A Sri Lankan walks a tightrope to collect toddy by tapping a palm tree.

The Government of Sri Lanka, through the Ministry of Coconut Industries and USAID, contracted with IFDC to make a 2-month study to determine what could be done to increase the consumption of fertilizer on coconut production. Mr. Williams visited Sri Lanka during May-June to develop an overall strategy and workplan.

The three objectives of the study were (1) to evaluate the suitability of the fertilizer mixtures now recommended by the Coconut Research Board and to recommend changes as necessary, (2) to review the location and storage capacities of existing Coconut Cultivation Board regional fertilizer warehouses, and (3) to

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Support Services

Headquarters—

Word Processing Specialists Play Vital Role



"Global search," "memory delete," "stored format," "merge file," "block and jump," and "file update"

represent a portion of the technical language heard in today's computer-age office setting.

This computer language comes naturally to nine Word Processing (WP) Specialists in IFDC's Word Processing Center as they produce technical reports, country studies, journal manuscripts, speeches, reference manuals, quarterly newsletters, and annual reports. These specialists not only use this language but also have the capability of producing reports in languages besides English, such as German, French, Spanish, and Portuguese. They can access the "world trade mode," which consists of print belts containing more than 40 dialects and languages.

Tracing the evolution of the IFDC Word Processing Center reveals that the idea of an IFDC WP Center originated with Mrs. Marjorie R. Engel, IFDC's Administrative Director. During the late 1960s in her previous employment, Mrs. Engel saw the need for a central typing staff.

"I felt that a central typing staff would result in not only increased productivity but also lower operating costs of an organization. But ultimately its greatest contribution would be better use of an organization's most important resource—its people. After learning that my idea had a name—word processing—I began to collect information on the system," Mrs. Engel said.

As this idea germinated, the Word Processing Center came into being in early 1975 after the creation of IFDC in December 1974. In the beginning, the IFDC WP Center had only one magnetic card typewriter. As the workload grew, more equipment was added to attack the

mountains of memos, letters, and reports. At present, there are nine keyboard terminals (five processors and four magnetic card keyboards) where material can be keyed onto diskettes or magnetic cards and three ink-jet printers where the copy can be printed out.

A word processor and a typewriter are alike in only one respect; they both have keyboards. Above the keyboard on the processor is a cathode ray tube (CRT)

"...its greatest contribution would be better use of an organization's most important resource—its people."

screen, which resembles a television screen. As the operator enters or revises material, that information appears on the screen. The convenience, speed, and potential for quality of word processors place them far above typewriters. When a WP Specialist keys in a report or publication, the information goes onto a magnetic

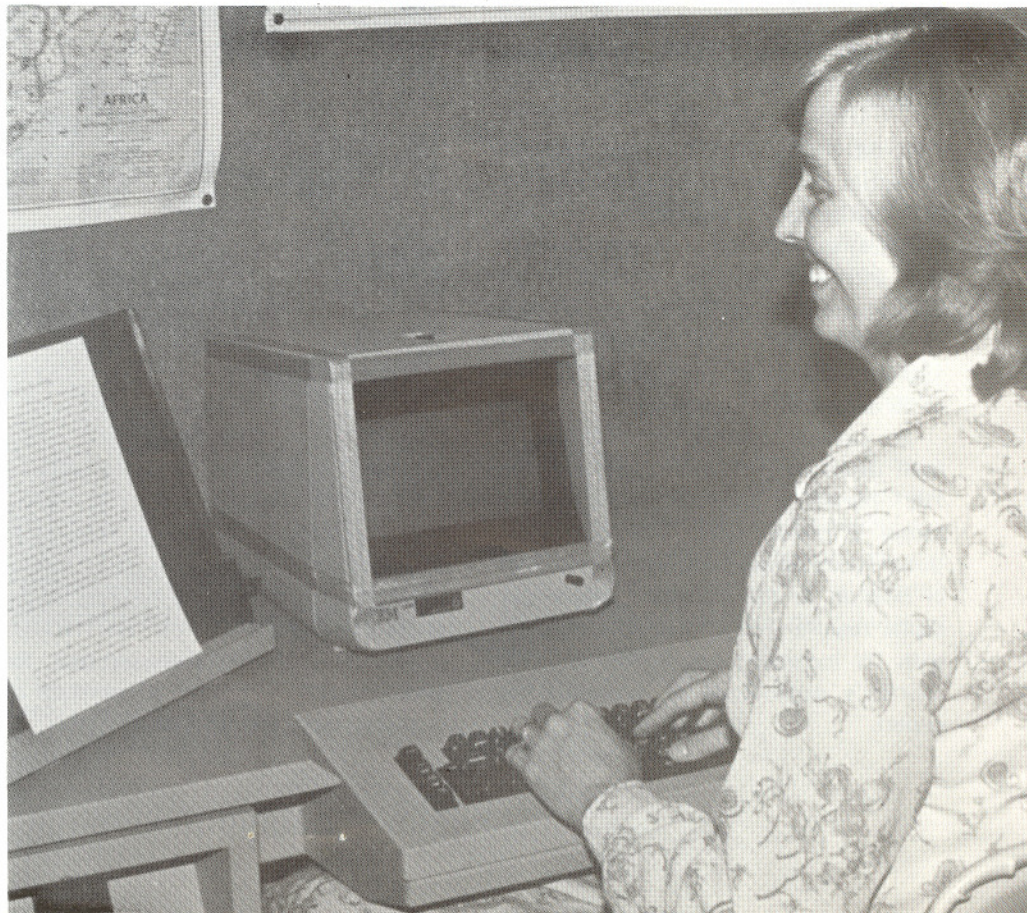
diskette. The capacity of each diskette is 130 pages, and there is no limit to the number of diskettes. The WP Specialist can call up the same document time after time for revision. On an ordinary typewriter, the work would have to be retyped each time.

The first IFDC WP Specialist, Mrs. Jane Goss, is a wizard at operating the WP equipment. Using her imagination, she can instruct the machines to perform innumerable operations to avoid monotonous tasks. "Global search" is one of the possible instructions.

"Global search saves typing and proofreading time. For example, if we discover that the name of a country is misspelled, we can instruct the processor to search for that particular character string and to substitute the correct character string," Mrs. Goss said.

Another interesting aspect of WP equipment is the speed with which the printer operates. The ink-jet printer prints 92 characters per second or 176 pages per hour. A cartridge of ink is capable of printing 4.2 million characters; the IFDC WP Center uses 2 cartridges of ink per month. The operation of the printer is fascinating—the ink spraying through a

Word Processing Specialist Donna Venable keys in a project report on a word processor.



matrix creates a series of dots which form a particular character.

IFDC sociologist, Dr. Kerry J. Byrnes, has used the WP Center in several applications. As part of his work in developing procedures to evaluate IFDC's training program, Dr. Byrnes has developed several tests to measure each program

"A word processor and a typewriter are alike in only one respect..."

participant's knowledge level, both at the beginning and end of a training program.

"These tests were prepared from a pool of multiple-choice questions covering various fertilizer-related topics included in IFDC's training programs," Dr. Byrnes said. "The WP Specialist assigned a code number to each question, keyed this information onto a diskette, and printed out a listing of the questions. Then, a team of fertilizer specialists in IFDC's Outreach Division evaluated each question on the list and made suggestions for improving many of the questions. The WP Specialist recalled the questions by code number, made the suggested corrections, and then generated a new list of questions."

Another application is the mailing list that is used in the distribution of the *IFDC Report* and letters to training program participants. If necessary, the data on the mailing list can be sorted by regions, countries, areas of specialty, etc.

Mrs. Goss pointed out another helpful application of WP equipment. "Our reports contain many Greek, mathematical, and technical symbols, which on a regular typewriter would require constant changing of a symbol element. However, the printer can print the symbols automatically because we can instruct it to change to a print belt containing symbols."

Another function that the IFDC WP Specialists call on the processors to perform is the layout of publications.

"By looking at the line count that appears at the top of the CRT screen, we

"Word Processing Specialists are 'special' people."

can plan the layout of a page containing text, tables, and figures. Most tables can be laid out on the processor, and space can be allowed for figures to be pasted in by the graphics personnel," another WP Specialist, Mrs. Kathy Adams, said.

With this issue of the *IFDC Report*, we are initiating the use of international development communication logos that were developed for the Clearinghouse on Development Communication, Washington, D.C. The purpose of these logos is to make it easier for readers to scan the newsletter to locate articles in their particular areas of interest.

The logos that we will be using and their represented concepts are:

Agro-Economic Research



Information



Integrated Development (Outreach)



Interpersonal Communication (Training)



New Technologies



IFDC WP Specialists operate another piece of equipment, called a magnetic card composer, to produce camera-ready copy for publications such as the *IFDC Report*, brochures, annual reports, and slides.

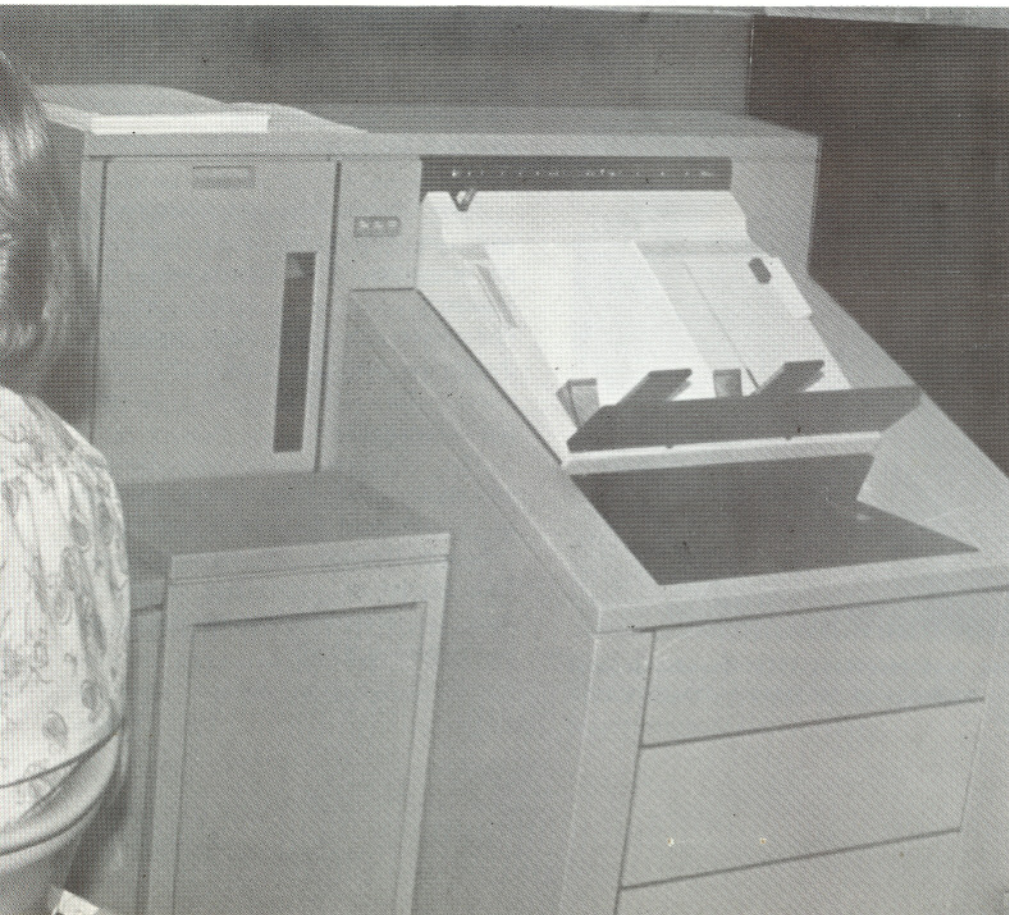
The primary operator of the composer, Mrs. Donna Venable, explained the advantages of a composer. "A cleaner, darker, neater type is possible. More variety in type styles also enhances the composer's appeal. Margins can be justified or ragged."

In the midst of all of this high technology, we may tend to forget the human factor. But, the coordinator of IFDC's WP Center, Mrs. Marie Stribling, is quick to bring us back to reality.

"Word Processing Specialists are 'special' people. They must be able to work together as a team. The nature of the operation requires a lot of interaction among the team members," the "coach" of this effective team said.

In a nutshell, word processing eliminates the monotony of repetitious tasks in an office and turns a typist into a special type of computer operator better known as a Word Processing Specialist, who speaks a unique language. Using such techniques as the "global search" command, the Word Processing Specialists help accelerate IFDC's global search for the answer to world hunger. ■

On the right is the ink-jet printer, which she will use to produce the copy.



Continued from p. 3

develop a plan for increasing fertilizer consumption in coconut cultivation with emphasis on the smallholder.

"Our plan is tailored specifically to get people to increase the consumption of fertilizer on existing palms and to replace old palms that are no longer producing. Old palms can be detected by thinning vegetation at the top of the trees. The production of palms that are 60 years of age and older is so low that it is uneconomical to keep them," Mr. Williams said.

It is profitable for the farmer to apply fertilizer to his coconut crop. The cost-benefit ratio based on 1981 prices is a return of about 4 rupees for each one invested in fertilizer. Experimental results at the Coconut Research Institute show

that unfertilized palms yield about 20 nuts, whereas fertilized palms can yield 70 nuts or more per palm.

To the people of Sri Lanka, coconut is a very important crop. "Out in the countryside, when no water is available, people drink water from the golden-colored king coconuts. At one time, they were scarce, and the king hoarded the prized nuts," Mr. Williams said.

Every part of the coconut is used in some way. The coconut oil is used in foods, soaps, and cosmetics. The fibers of the husks are used to make household brushes, door mats, brooms, and ropes.

"The husks are also used in the conservation of water. The Sri Lankans dig a large hole, fill it with husks, cover them and allow them to absorb water. Then

during a drought period, they have spare water," Mr. Williams said.

The farmers also place the husks under the palm trees and allow water to leach out the plant nutrients for recycling in plant growth.

The production of toddy is another important segment of the coconut industry in Sri Lanka. Toddy, which is juice collected from the top of the tree trunk, is used as a beverage. It is produced along the coastal area from the capital, Colombo, to Galle.

It is clearly evident that coconuts are important to Sri Lanka's economy. If IFDC's recommendations are implemented, coconuts will be in plentiful supply in Sri Lanka. ■

Headquarters—

Research on Briquettes May Benefit the Small Farmer



An Indonesian paddy farmer may someday be able to produce his own urea briquettes for deep placement.

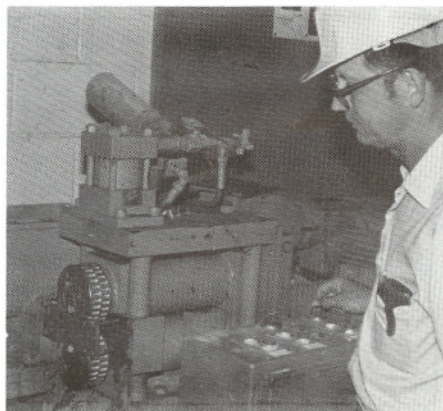
His benefactors may very well be IFDC researchers who are studying the production of urea briquettes using a laboratory-model briquetter. IFDC Chemist, Mr. Jerry Clemmons; Mr. Shmuel Carmon, Chemical Engineer; and other IFDC staff are conducting research on a briquetter that was acquired by the Fertilizer Technology Division in July. The model they are using produces 50-100 kg of briquettes per hour.

"We will determine the economics of briquetting in comparison with that of prilling and granulation. Various applications will be studied including using scrap material such as that contaminated with floor sweepings," Mr. Clemmons said.

It may be much easier to transfer the production technology of briquetting than it is to transfer other methods of urea production. The simplicity of the machine's operation makes it a likely candidate for farm- or village-level application.

Inside the briquetter's feed mechanism, paddles mix the fertilizer material. An auger force feeds the material between rolls and into pockets on the sides of the rolls. The material is compacted; the rolls turn and discharge the briquettes in sheets. The sheets of material are then placed in a revolving drum for separation into individual briquettes.

IFDC will test other briquetted materials besides urea, such as TSP/urea, SSP/urea, phosphate rock/sulfur, and phosphate rock/urea.



Mr. Jerry Clemmons, IFDC Chemist, prepares to produce urea briquettes in the IFDC pilot plant.

"Researchers in the People's Republic of China and India, plus possibly other countries, have also produced briquettes for deep placement as a means of improving nitrogen use efficiency. Until now the Chinese have concentrated on ammonium bicarbonate but are also planning to use urea in the future; whereas, India's researchers have used urea," the Director of IFDC's Fertilizer Technology Division, Mr. Owen Livingston, said.

"Briquettes appear to be most suitable for deep placement in paddy rice, but equipment will have to be designed for applying the briquettes," Mr. Clemmons said.

"The Chinese have also experimented with equipment for deep placement of briquettes. The International Rice Research Institute (IRRI) in the Philippines also has a group engaged in developing fertilizer application equipment for the small farmer," Mr. Livingston said.

The Fertilizer Technology Division will supply their experimental products to researchers of the Agro-Economic and Outreach Divisions for greenhouse and field studies on paddy rice in selected Asian countries, including the Philippines and Indonesia. ■

Training Program Activities

Headquarters—

Maintenance and Production Management Training Aids Fertilizer Producers



The production manager of the Saudi Arabian Fertilizer Company, Mr. Hussein Eid Jubeihi, of Damman, Saudi Arabia, was a participant in the Maintenance and Production Management Training for Fertilizer Producers, July 13-31, at IFDC Headquarters. Mr. Jubeihi said that he gained an insight during the seminar that will help him in organizing the personnel under his supervision.

"I feel that I'll be able to apply program evaluation and review technique (PERT) more effectively in my plant, after seeing it demonstrated so well and by participating on a team that applied the technique," Mr. Jubeihi said.

Another training participant, Mr. Handriffin Nur of P.T. Pupuk Kujang, Indonesia, told of the effectiveness of the lecturers: "They opened our minds; they helped us to understand new techniques."

The chief process engineer of the Federal Superphosphate Fertilizer Company of Kuduna, Nigeria, Mr. Abdulmumini Adisa Yusuf, summarized the result of the training program.

"The aspect of the program that impressed me most was the constant reminder of the importance of setting objectives, planning, and working toward a particular goal," Mr. Yusuf said.

The maintenance supervisor of the Moron plant of Petroquímica de Venezuela, S.A. (PEQUIVEN), Mr. Manuel Salvador Añez Marcano, has definite plans for applying what he learned during the training program.

"I'm going to work on our work-order system. I plan to use more PERT in planning, organizing, and applying proper control," Mr. Añez said.

These four participants echoed the sentiments of the total group of 33 fertilizer producers from 11 countries who attended the 3-week program. This training program was under the direction

of Mr. J. J. Schultz, IFDC Technical Training/Assistance Coordinator, of the Fertilizer Technology Division. It was designed to improve the efficiency of fertilizer plants through management and the continued development of the human resource.

The first week of the training program gave the participants an overview of fertilizer sector highlights, including fertilizer supply and demand, production economics, and fertilizer technology and research activities.

Industrial experience provided the foundation of the second week of course work. Two fertilizer industry case histories, Fertilizantes Mexicanos, S.A. (FERTIMEX) of Mexico and P.T. Pupuk Sriwidjaja (P.T. PUSRI) of Indonesia, were presented to demonstrate the selection and application of management systems to implement and operate a variety of fertilizer production units. Mr. Adolfo Sisto presented the case history of FERTIMEX, and Mr. John A. Burnett, Jr., presented the P.T. PUSRI case study.

During the final week, the participants chose a 3-day visit to fertilizer plants in either Donaldsonville, Louisiana, or Lakeland, Florida. These field trips to fertilizer production facilities were designed to give the participants a first-hand view of maintenance and production management practices.

Mr. Schultz, who accompanied those participants choosing the Louisiana tour, summarized the trip:

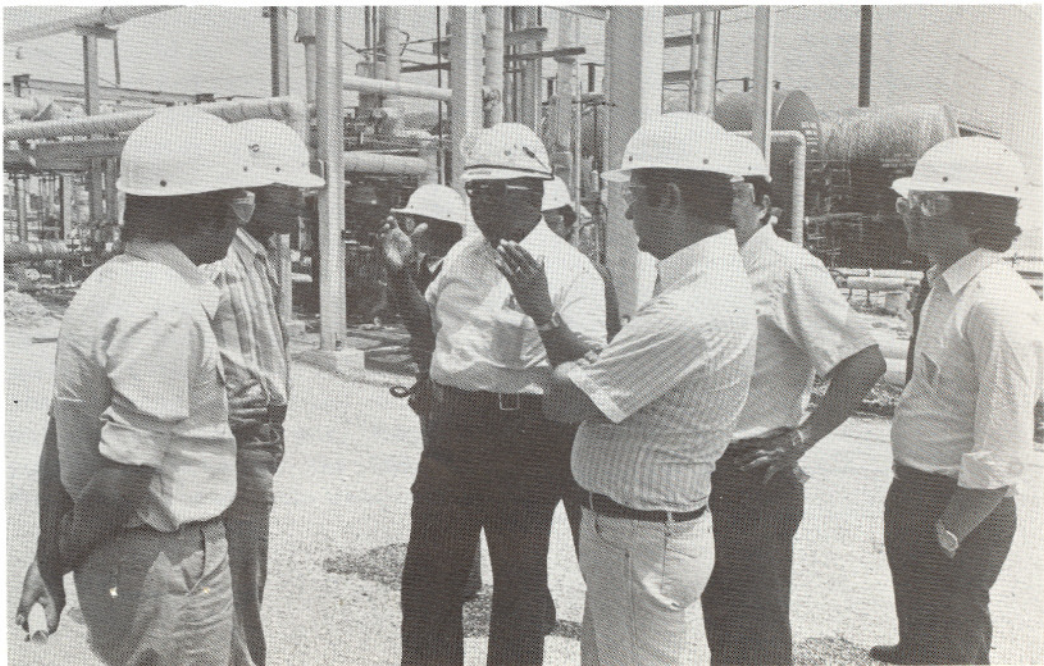
"The tour of the efficient fertilizer complex operated by Agrico Chemical Company was quite enlightening for the participants. The discussions by plant personnel were extremely informative and were followed by lively question and answer periods."

Accompanying those participants who opted for the Florida trip was Mr. Owen Livingston, Director of IFDC's Fertilizer Technology Division.

"The participants observed efficient maintenance and production practices firsthand at the Royster Chemical Company. The visit to the phosphate mine and beneficiation plant of International Minerals and Chemical Company, as always, was a highlight of the program," Mr. Livingston said.

The consensus expressed by the participants at the conclusion of the seminar was that it had been a profitable experience, and they would recommend the program to their colleagues. ■

Mr. Jethro White, an Area Field Maintenance Superintendent of Agrico Chemical Company, Donaldsonville, Louisiana, describes Agrico's maintenance operations to training program participants.



Recent IFDC Publications

CORROSION MANUAL

Increased demand for food throughout the world and particularly in developing countries has necessitated the production of greater quantities and different kinds of fertilizer than have been used in the past. In addition, many of the fertilizers or fertilizer materials are being produced and used in areas where they were previously unknown. Corrosion of equipment associated with the production, distribution, and application of these materials adds significantly to the cost. As a result, there is an urgent need for a manual which describes methods of determining the corrosion characteristics of these materials and minimizing such corrosion.

This manual, prepared by Michael Schorr, Materials Specialist, deals primarily with corrosion caused by wet-process phosphoric acid, the principal intermediate in the production of phosphate fertilizers.

INTERNATIONAL FERTILIZER MARKET INFORMATION SOURCES

To monitor and assess the international market conditions of key fertilizer products, raw materials and intermediates, decisionmakers of fertilizer supply and marketing strategies need several types of information and must know where to locate such information. Furthermore, they must develop a mechanism for faster information access and strengthen their information analysis capabilities.

This publication, prepared by Yao H. Chuang, IFDC Market Development Economist, attempts to: (1) identify the types of information which are considered essential for the decisionmakers and (2) highlight the published and unpublished information sources.

For a complete list of IFDC publications, write:
Publications List
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Muscle Shoals, AL 35660-1040
U.S.A.

NIGERIA FERTILIZER SECTOR: PRESENT SITUATION AND FUTURE PROSPECTS

Nigeria, the most populous country of Africa, has a potential food deficit of approximately 19 million tons of cereal equivalent by 1985 if present trends continue. Because Nigerian soils have a generally low level of soil fertility, the role of fertilizers is receiving particular emphasis.

This publication reviews fully all of the information related to fertilizer use in Nigeria, identifies constraints to its increased use, and recommends actions which, if undertaken, would accelerate food production based on the rational use of fertilizer and its related inputs.

The study was prepared by Dr. A. O. Falusi, Agricultural Economist, and Mr. L. B. Williams, Regional Coordinator—Africa, IFDC.



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