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Report

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

IFDC Helps Lay the Groundwork for an Albanian Agricultural Statistical System

IFDC recently participated in a project in Albania that produced one of the elements—an area sampling frame—that will lead to the creation of a national agricultural statistical system in the country. This system will, in turn, contribute to increased agricultural productivity and help sustain the free market economy, which was recently introduced in that country. To make better decisions regarding the future of agriculture in Albania, its policymakers must have access to a reliable national agricultural statistical system.

As part of a project, Support to Restructuring Albania's Fertilizer Subsector, sponsored by the U.S. Agency for International Development, IFDC recently collaborated with the Directorate of Information Services and Statistics, Ministry of Agriculture and Food, Albania, and the Agricultural Assessments International Corporation, Upper Marlboro, Maryland (U.S.A.), to design an area sampling frame (ASF) for Albania that will enable agricultural officers and survey designers to select representative samples and collect data for a variety of purposes.

The primary objective of the ASF design in Albania was to provide the basis for periodically estimating cropland areas for major crops, forecasting production of crops, and determining products and amounts of fertilizer applied during the cropping season. A long-term objective is to provide the basis for the establishment of a national agricultural statistical system for monitoring and reporting agricultural development.

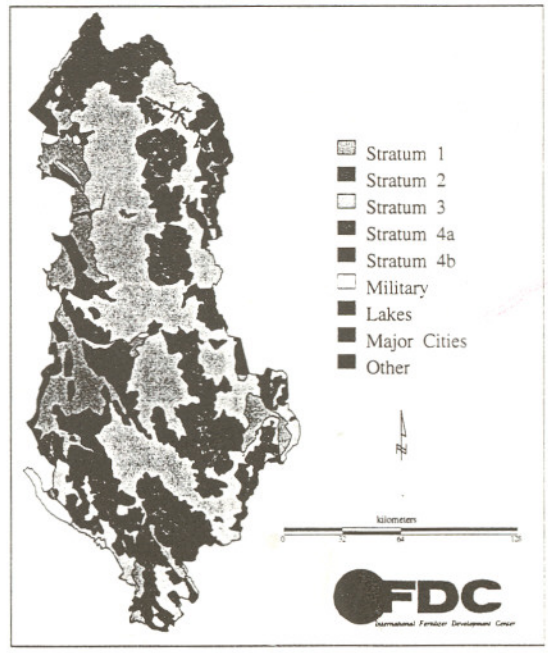
The study team conducted a survey to estimate agricultural land and fertilizer use and develop techniques to forecast wheat and maize production; they also used the ASF technology to refine previous land stratification and sampling. The area sampling frame, which was constructed, has unlimited potential uses in Albania. Future surveys of populations can be composed of reporting units like households, crops, livestock, or any other definable unit that can be uniquely associated with area or spatial data. Adaptability to a particular information system (agricultural statistics and marketing) and versatility are strong attributes of the area sampling frame that was developed.

"The minimum requirement for the application of the ASF survey was maps and satellite imagery for dividing the land area into strata and small area sampling units or segments that have clear physical boundaries and could be accurately identified by an interviewer," says Dr. Julio Henao, IFDC Biometrics Scientist, and IFDC member of the study team. "The sampling units were randomly allocated to the strata. The area sampling frame and an associated computerized system were designed and implemented in a manner that will allow the sample unit of information to be digitally stored and will facilitate estimation of parameters and sample analysis. The system has been designed to support users' needs for agricultural statistics including cropped land, agricultural resources, and selected socioeconomic indicators."

For the design and construction of the area frame across the country, maps were needed as well as available reports on topographic features, crop production, crop and fertilizer management, fertilizer use, and intensity of land use in the country. Maps and satellite imagery such as

(Continued on page 8)

Albania Land Area Stratification.



(Map by Jimmy Brink)

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President's Report

(Photo by Charles E. Butler)

Dr. Amit H. Roy
IFDC President and Chief Executive Officer

It is a pleasure to introduce this issue of the *IFDC Report*. In the following pages our readers will learn more about ongoing, completed, and planned activities that focus on our broadened mission of increasing and sustaining food and agricultural productivity in developing countries through the development and transfer of effective and environmentally sound plant nutrient technology and agribusiness expertise.

IFDC presently has agribusiness projects ongoing in Albania, Bangladesh, Egypt, and Romania. The Center is conducting technology transfer initiatives in Colombia, Costa Rica, El Salvador, Mexico, Tanzania, Thailand, Venezuela, and Zimbabwe. Additionally, IFDC is conducting activities involving crop simulation modeling and information management systems in Albania, Brazil, Philippines, Romania, and Uruguay. Projects involving nutrient dynamics research are underway in Brazil, Colombia, Niger, Philippines, Togo, Uruguay, Vietnam, and Zimbabwe.

International Centers' Week, 1993

During the last two weeks in October several IFDC staff members and the Chairman of our Board of Directors attended various sessions of the International Centers' Week (ICW) in Washington, D.C. An IFDC Donors' Meeting, conducted in connection with ICW '93, was attended by 22 people. Featured at the meeting were presentations on IFDC's crop modeling activities and the Center's work in Africa.

November Board of Directors' Meeting

The IFDC Board of Directors' Meeting, which was conducted during November 10-12, 1993, attracted the full membership of the Board. Two distinguished members of the world fertilizer sector have joined our Board: Luc Maene, Secretary General, International Fertilizer Industry Association (IFA), Paris, France, and Gary D. Myers, President, The Fertilizer Institute (TFI), Washington, D.C. (Profiles of these new members will be presented in a future issue of this newsletter.)

During the Board Meeting the Directors received copies of the "Report of the President and Chief Executive Officer." This report highlighted the activities of IFDC during 1993. Specifically, the following salient points were emphasized in the report:

* IFDC's agronomists and policy economists are developing strategies to attain sustainable agricultural development through efficient, environmentally sound fertilizer practices supported by economic policies that are conducive to private agribusiness development.
* Significant progress has been made in the implementation of a systems approach to conduct research on plant nutrient management issues that are relevant for sustainable agriculture and environmental protection. Basic components of this approach are the development and application of simulation modeling coupled with a Geographic Information System, research to improve understanding of nutrient dynamics, research in economics and policy issues, and development of information management systems.
* IFDC has made considerable progress in its efforts in policy reform and market liberalization. Evidence of its successes can be found in Bangladesh in the development and implementation of a free and competitive market system—in Albania where the Center has instituted the first successful privatization project in that country—in Romania where IFDC

has introduced the farming sector to the free market system—in Egypt where the Center has aided in policy reform and agri-input dealer training.

* IFDC-Africa has made significant progress toward the buildup of indigenous institutions and capacity that are needed to develop new or adapt existing technology and ensure its successful transfer to the farmers of the West African subregion. This has been achieved through activities carried out with more than 800 farmers and 138 research and extension personnel in restoring the fertility of degraded soils in Ghana, Niger, and Togo; the training of nine Burkinabes in agri-inputs management; the joint study in Ghana with Ghanaian experts of fertilizer privatization; the establishment of fertilizer policy research units in Ghana and Mali; and the successful completion of a train-the-trainer exercise in agronomic data analysis.

Amit H. Roy

AFTMIN-6 Meeting in Ghana Attracts Seventy Delegates from Twenty Countries

The Sixth Annual Meeting of the African Fertilizer Trade and Marketing Information Network (AFTMIN-6), which was organized by IFDC-Africa and the Ghana Ministry of Food and Agriculture, was conducted during November 2-4, 1993, in Accra, Ghana. The meeting attracted 70 delegates from 15 countries in Africa, 4 in Europe (France, Finland, Netherlands, and the United Kingdom), and the United States.

"The meeting focused on a discussion of the principles of bulk blending and the potential use of blended fertilizers as an alternative to complex fertilizers, traditionally used in sub-Saharan Africa," says Dr. Henny Gerner, IFDC-Africa Agro-Economist/Data Base Manager and AFTMIN Coordinator.

"Bulk blending is the process of blending two or more straight fertilizers that are chemically nonreactive or minimally so," says Souleymane Diouf, IFDC-Africa Marketing Specialist, and a member of the reporting committee at AFTMIN-6. "A compound coming from a bulk-blending plant is a blended fertilizer or a blend. A complex compound is produced by a chemical process and contains the same nutrient composition in each granule. Agronomists, economists, fertilizer manufacturers, and, in particular, bulk-blending experts addressed the AFTMIN-6 meeting on the advantages and disadvantages of the bulk-blending process, the ingredients used in blends, fertilizer product specifications, fertilizer quality control, and bagging and bags."

The welcome address was presented by Dr. Uzo Mokwunye, Director of IFDC-Africa. Another IFDC staff member, T. Alan Nix, Production/Marketing Specialist, presented two papers—"An Overview of Fertilizer Blending in the United States and Europe" and "Selection of Raw Materials for Bulk Blends." Other presentations were made by representatives of African, European, and U.S. fertilizer industries and African universities.

Several conclusions were derived during the meeting's deliberations. Gerner and Diouf outlined these conclusions as follows:

1. There is a need to develop an adequate domestic supply of fertilizers at the farm level on a timely basis and at a reasonable cost. Quality blended fertilizers are an alternative to the complex fertilizers traditionally used in sub-Saharan Africa and can contribute to this purpose.
2. It is too early to assess whether blended fertilizers will be accepted by sub-Saharan African farmers.
3. The African fertilizer blending situation is much different from that of other parts of the world.
4. The following constraints for bulk blending were identified:
   a. Potential for not realizing expected cost advantages.
   b. Chemical and physical incompatibility of some raw materials in the production environment.
   c. Fear of segregation during transport over long distances.
   d. Financing of capital investment and working capital due to the extra storage requirement and the necessity of importing and storing large quantities of raw materials.
   e. Availability and management of good quality raw materials.
   f. Farmer's acceptance of blends.

The delegates to AFTMIN-6 reached a consensus regarding five recommendations for future work that should be done involving blended fertilizers. They are as follows:

1. Preliminary soil studies should be done to determine specific fertilizer recommendations for different agricultural zones. The soil studies should be updated periodically.
2. The establishment of soil-testing laboratories should be promoted.
3. Farmers should be involved in on-farm trials to demonstrate the economic and agronomic properties of different forms of fertilizers.
4. An economic study should be conducted to determine the feasibility of establishing small-scale plants close to the consumer.
5. The matters regarding bulk blending and blended fertilizers should be discussed by the National Input Development Units, which are presently being proposed by IFDC-Africa. Funding is needed to implement national fertilizer development activities and to strengthen national capacities. The Committee recommended that IFDC-Africa approach concerned governments and donors for funding.

Albania Workshop

(IFDC/Albania staff photo)

As part of its continuing agribusiness project in Albania, IFDC presented two regional workshops on management skills development and improvement of payment procedures through the banking system in Albania during October-November 1993. These workshops were targeted toward directors and chief accountants of the branches of commercial banks in the region, fertilizer dealers, and managers of fertilizer factories. Some of the topics of discussion included: management and management processes; organizational structures; bank management, branch control and the loan management process; information and monitoring; budget evaluation; and accounting and financial analysis and statements. Pictured in the photo above are Ted Landau, USAID Officer in Charge for Albania, Romania, and Bulgaria; Diane Blanne, USAID representative in Albania; an Albanian interpreter; Llazar Kora, Deputy Minister for Agriculture and Food, Government of Albania; and Steve Haynes, USAID Agricultural Officer and the Director of the Directorate of Chemicals, Government of Albania. Pictured on the far right is N. H. Majumder, IFDC/Albania Credit and Financial Specialist, who is making a presentation on financial statement and analysis.

Malian Scientist Evaluates Options for Use of Indigenous Resources

For soils in the tropics, the use of indigenous phosphate rocks to supply phosphorus nutrient for crop production may be an economically attractive alternative to the more expensive imported phosphate fertilizers such as triple superphosphate (TSP) and diammonium phosphate (DAP) for some developing countries. One of these is the landlocked country of Mali in West Africa. The country has a substantial reserve of phosphate deposit in the Tilemsi Valley region. The chemical reactivity of Tilemsi Valley phosphate rock is medium to high, and it has been proved that the phosphate rock is suitable for direct application on crops grown on acid soils. However, the agronomic value of phosphate rock is variable, and factors including the soil and cultural practices affect the availability of the phosphorus to plants.

Although the Tilemsi Valley phosphate rock is suitable as a directly applied fertilizer to acid soils in Mali, it has been shown that it is not an effective phosphorus source for crops grown on soils that are neutral in soil acidity because of a decrease of acidity effect on phosphate rock dissolution. Some modifications of the phosphate rock are needed to increase its agronomic effectiveness in neutral soils. The processes of modification also should be economically cost effective with respect to the imported TSP or DAP fertilizers. With these ideas in mind, Dr. Amadou Gakou, a graduate student from Mali, came to IFDC in April 1991 to conduct a research project as part of his graduate program toward a Ph.D. degree in soil science. The degree was granted in August 1993 by Auburn University, Auburn, Alabama (U.S.A.).

At IFDC Gakou worked under the guidance of Dr. S. H. Chien, Senior Soil Chemist and Adjunct Professor of Auburn University. According to Chien, one of the objectives of Gakou's research was to investigate the effect of soil properties on the agronomic effectiveness of mixtures of Tilemsi Valley phosphate rock with TSP and DAP.

Because of its high iron and aluminum oxides content, IFDC researchers reported that the Tilemsi

Valley phosphate rock is not suitable for the process of partial acidulation. Partial acidulation of such phosphate rock frequently results in a product with low water solubility and poor agronomic effectiveness. To avoid the detrimental problem of iron and aluminum oxides, IFDC's researchers have developed an alternative technology to partial acidulation, that is, dry compaction of phosphate rock with soluble phosphate sources. In Gakou's work the Tilemsi Valley phosphate rock was compacted with TSP and DAP.

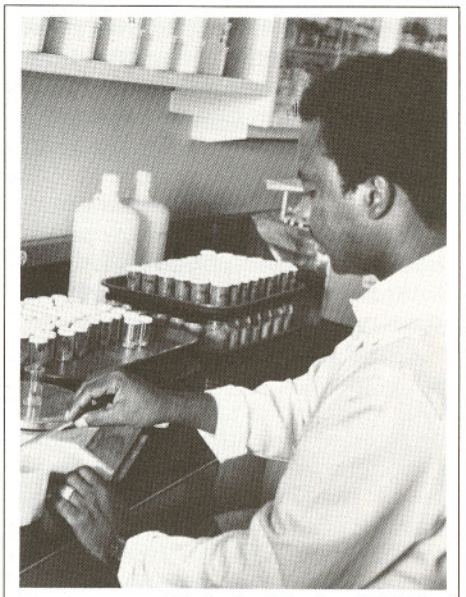
This research work included a laboratory soil incubation study and greenhouse experiments with maize as the test crop. Two United States soils (one sandy and one clayey), having certain properties similar to those of some agricultural soils in Mali, were used in the experiments. In addition, two soils selected from Mali were used in a soil incubation study.

"The greenhouse results confirmed that finely ground Tilemsi Valley phosphate rock alone was relatively ineffective in supplying available phosphorus for maize grown on neutral soils," says Gakou. "Its agronomic effectiveness was found to be only 10%-26% of that of TSP and DAP. However, when Tilemsi Valley phosphate rock was mixed by compaction with TSP or DAP, its effectiveness was significantly increased." Mixing of phosphate rock with water-soluble phosphate can result in an increase of phosphorus availability from phosphate rock because of a better root development at the early plant growth stage due to water-soluble phosphate (starter effect). Furthermore, the interaction between phosphate rock particles and the monocalcium phosphate contained in TSP can release additional water-soluble phosphate from phosphate rock due to the acidity effect.

The results showed that one compacted product (PR + TSP) was as good as TSP alone whereas the other compacted product (PR + DAP) was 80% as effective as DAP alone on the clayey soil. On the sandy soil, one compacted product (PR + TSP) was 70% as effective as TSP, and the other compacted product (PR + DAP) was 66% as effective as DAP. The results suggest that a mixture of phosphate rock with TSP or DAP by dry compaction is an attractive process to increase the agronomic effectiveness of phosphate rock containing high amounts of iron and aluminum oxides for crops grown on neutral soils. Another advantage of compaction is that it results in a granular product that is nondusty and more acceptable by the farmer. The effectiveness, however, depends on the soil texture; it is more effective in clayey soil than in sandy soil.

Gakou plans to continue to evaluate the agronomic effectiveness of these types of compacted fertilizer products made from Tilemsi Valley phosphate rock under field conditions after he returns to Mali in early 1994. If the agronomic field results confirm their effectiveness, it may pave the way for the Malian farmers to adopt these types of fertilizers, based on agronomic and economic reasons, for crop production on neutral soils.

Dr. Amadou Gakou, an agronomist from Mali, plans to continue conducting research related to the agricultural developments of his country when he returns to Mali.



(Photo by Charles E. Butler)

IFDC Board Chairman Presents Keynote Address to Fertiliser Association of India

Dr. W. David Hopper, Chairman of IFDC's Board of Directors, has had a long and rewarding association with Indian agricultural development. Because this association has spanned several decades, the former development official has observed the ebbs and flows of agricultural development of that country.

Hopper's association with Indian agriculture began early in his career when he served as a Social Science Research Fellow while studying the economic organization of a village on the Gangetic Plain of North Central India. Later, he returned to India as an agricultural economist at the Indian Agricultural Research Institute (IARI), under sponsorship of the Ford and Rockefeller Foundations. Subsequent to his tenure with IARI, Hopper later was able to observe the development of Indian agriculture from the vantage point of the World Bank, where he served as Vice President for the South Asia Region.

Returning to India some 40 years after his first stint there, Hopper was able to draw from a breadth of experience in that country as the keynote speaker at a seminar entitled "Emerging Scenario in Fertiliser and Agriculture: Global Dimensions," conducted by the Fertiliser Association of India. The IFDC Board Chairman delivered a presentation entitled "Indian Agriculture and Fertiliser: An Outsider's Observations" on December 6, 1993, at New Delhi.

In his introduction, Hopper reminded his audience that "26 years ago Indian farmers had just completed the first commercial planting of the new dwarf varieties of wheat. Those plantings were nurtured by the heaviest application of fertilizer in Indian history. The outcome of these plantings in the spring of 1968 was 50% above the previous 12 million-ton record harvest of 1965. The harvest of 1968 marked a transition from an agrarian India to an Indian agriculture founded on modern science-derived technologies."

The main thrust of Hopper's speech was concerned with the im-

plications of that transition in Indian agriculture. Transporting his audience back in time for a brief look at the past, Hopper recounted that India's agricultural development strategy before the very difficult drought years of the mid-1960s was based on twin thrusts—a slow increase in acreage and improved cultural practices to enhance yields. The result of this development strategy was an almost stagnant growth in foodgrain output and a resultant steady increase in imports from the United States and food aid from other nations.

"Along with others, I argued that the farmers, the soils, and water of India could easily feed the nation if the needed investments to support a modern agriculture were sanctioned by the Planning Commission. . . . Finally, after becoming exasperated by the stubborn 2-year drought of the mid-1960s, the Minister of Food and Agriculture placed the nation firmly on the path of modern agricultural development in March 1966 by importing 18,000 tons of dwarf wheat seed from Mexico. . . . The productivity of the new seeds was ensured when the World Bank and the bilateral aid donors of the Indian Consortium agreed to provide fertilizer imports for the nation's wheat farmers."

The result is history—Indian grain production broke all previous records. "For all of us associated with the beginning of that history, it is a proud record," said Hopper.

As the arable land of the nation diminishes under increasing population pressures, future growth of the nation's food supply can come only from a continued growth in yields. In other words, "the factors of production that will promote the increase of grain yields must become the major ingredient of agricultural development policy, indeed, for any national policy for food security. Obviously, fertilizer is one of the most significant factors of production. Fertilizer policy, therefore, must be at the center of any policy for the nation's food economy," Hopper said.

Looking at the present situation, Hopper pointed out that of the 180 plus million tons of foodgrain produced in India today, fertilizer probably accounts for 75 to 90 million tons of the total. He emphasized that the fundamental role of fertilizer in the growth of India's basic food supply is abundantly clear—almost one-half of the nation's domestic food production can be attributed to the application of plant nutrients.

In discussing the future of India's domestic fertilizer industry, Hopper remarked that there are "two components that have not been adequately articulated by the seers of that future—the financial health of the nation's fertilizer industry and the degree to which India places its fundamental food security outside its borders."

The IFDC Board Chairman made specific recommendations for actions that should be taken to ensure the financial health of India's fertilizer industry. "In the intermediate term, large parts of India's nitrogen fertilizer industry must become more efficient in both the conversion of feedstock and in the use of energy. By reducing the cost of natural gas to the industry and eliminating all subsidies, industry units will be forced to compete on the basis of production efficiency. Farm-gate prices will quickly adjust downward to reflect the costs of the more efficient production units. The less efficient companies will find it necessary to undertake investments for plant modernization and rehabilitation in response to the play of competitive market forces resulting in a healthier nitrogen industry and spinning off substantial secondary benefits to the total economy."

Regarding food security, Hopper emphasized that "India cannot leave to international market forces the fundamental needs of its food economy. Its farm and food demands are too large to give the nation the luxury of being able to choose imports over domestic production in accordance with short or even intermediate global market circumstances."

(Interested parties may obtain copies of the complete keynote address from IFDC or the Fertiliser Association of India, 10, Shaheed Jit Singh Marg, New Delhi 110 067, India.)

Study Tour

Jani Sila, Chief Engineer, Fier Nitrogen Fertilizer Plant, Albania, traveled with J. Ramon Lazo de la Vega, IFDC Engineering Specialist, to Alabama, Arkansas, Louisiana, and Tennessee to visit nitrogen fertilizer plants. The purpose of Sila's study tour was to obtain firsthand information on how these types of plants are managed, operated, and maintained in the United States. Sila was very impressed with the way that the plants are operated in the United States. He could see the difference that exists between privately owned and state-owned companies, especially the number of people employed to operate and maintain the production units. Sila will try to implement some of the management, operating, and recordkeeping procedures that he observed on this tour when he returns to the nitrogen complex where he is employed in Albania. Pictured at the Agricultural Minerals Corporation (AMC), Blytheville, Arkansas (U.S.A.), are from left: Don Malone, Urea/Shipping Superintendent, AMC; Pete Miller, Plant Manager, AMC; and Jani Sila.

(Photo by J. Ramon Lazo de la Vega)

IFDC STAFF CHANGES—APPOINTMENTS, DEPARTURES, AND RETIREMENTS

New Employees

Souleymane Diouf, Marketing Specialist, recently joined the IFDC-Africa Fertilizer Marketing Research and Information Project. Prior to his appointment to IFDC-Africa, Diouf worked for Senchim, the sales subsidiary of Industries Chimiques du Senegal (ICS) for 8 years. This position allowed Diouf to gain considerable experience in the field of fertilizer marketing in West Africa.

Diouf is originally from Senegal. He holds a Master's degree in international trade from the Université de Dijon and a diploma from the Institut d'Etudes Politiques d'Aix-en-Provence, France.

Paul W. Wilkens, Scientist–Programmer, joined the IFDC staff during 1993. Prior to his appointment with IFDC, Wilkens was a postdoctoral research fellow at the United States Dairy Forage Research Center, Michigan State University. At Michigan State, Wilkens was responsible for constructing a dynamic alfalfa computer simulation model as part of the dairy forage systems model, DAFOSYM.

In addition, Wilkens gained experience in crop modeling as a computer programmer/systems modeler with the Department of Agronomy at Cornell University.

Wilkens received a B.S. degree in agronomy from Iowa State University; M.S. degree in agronomy, crop production, and physiology from Iowa State; and a Ph.D. in agronomy and crop science from Cornell University.

The newest member of the crop modeling group already has several publications to his credit and is the recipient of a number of honors and awards.

Donald C. Young, Senior Specialist–Phosphate Production/Financial Analyst, recently joined IFDC. Young comes to IFDC from Australia where he has worked in the fertilizer industry for over 40 years. Immediately prior to joining IFDC as a full-time employee, Young served as a consultant on two IFDC teams carrying out technical/economic evaluation of phosphate fertilizer complexes in Albania and Venezuela.

Young's experience in Australia covered the technical and production areas of sulfuric acid plants operating on sulfur and smelter/roaster off-gases, a phosphoric acid plant, continuous single superphosphate plants, and associated raw material receival systems and product storage and dispatch facilities. For the past 18 years, he managed fertilizer factories for the Australian Fertilizer Ltd./Incitec, Ltd., Australia's largest fertilizer company.

Young holds a B.S. degree in industrial chemistry from the University of New South Wales.

Departure

M. Terry Frederick, who was formerly Chief of Party, IFDC-Romania, posted in Bucharest, Romania, departed IFDC in October 1993. Frederick is presently Director of Services and Marketing with Applied Chemical Technology (ACT), Inc., Florence-Lauderdale Industrial Park, Florence, Alabama. ACT is a private consulting engineering firm for the chemical industry. The firm specializes in the design and construction of large- and small-scale production plants for innovative chemical products and processes.

During his employment with IFDC over the past 18 years, Frederick served in a variety of capacities. Besides heading up the Romania project, he previously served as Development Officer; Technology Division Acting Director; Coordinator of Engineering and Training at IFDC-Africa, Lomé, Togo; and Chemical Engineer in the Outreach Division.

Frederick holds a B.S. degree in chemical engineering from Auburn University and an M.B.A. degree from the University of North Alabama. Over the past 15 years, he has worked in 30 different countries, authored several reports and publications, and received a number of professional honors and awards.

Retirements

George W. Bolds, formerly IFDC Senior Production Specialist, retired from IFDC in late 1993. Bolds served IFDC as Pilot Plant Operations Coordinator for 16 years. Prior to joining IFDC Bolds was employed for 25 years by the Process Engineering Branch of TVA's National Fertilizer Development Center.

While with IFDC, Bolds provided technical assistance in plant assessments, modifications, construction, and commissioning of fertilizer plants located throughout Latin America, Asia, and Africa. He provided assistance in plant design and layout in India, Togo, and Egypt; operator training and plant startup in Indonesia, Malaysia, and Colombia; technical consulting in Brazil, Venezuela, Zambia, Nigeria, and Colombia; plant assessments in Zambia, Nigeria, Chile, and Albania, and technical seminars in Brazil, Colombia, and Egypt.

Bolds continues to serve IFDC on an intermittent basis as a consultant.

Jerry R. Clemmons, formerly Senior Chemistry Specialist, retired from IFDC in late 1993. Clemmons has been involved in fertilizer research for over 32 years. Before joining IFDC, he worked for 18 years at TVA's National Fertilizer Development Center. He has had extensive experience in the fabrication, construction, operation, and maintenance of experimental equipment and in the collection and evaluation of data obtained from bench- and laboratory-scale fertilizer processing equipment. His areas of specialty include: production of coated fertilizers, processing of phosphate rocks into fertilizer intermediates such as phosphoric acid, the production of products such as superphosphates and ammoniated phosphates, and calcination of phosphate rock.

Clemmons holds a B.S. degree in chemistry from the University of North Alabama. During his career, he has authored or contributed to over 25 publications and technical reports. Clemmons presently serves IFDC as a consultant on an intermittent basis.

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(Continued from page 1)
Landsat thematic mapper have proven useful for estimating land areas and for land stratification. They were used to stratify the country, identify agricultural resources in low and mountainous areas, locate permanent physical boundaries, and conduct preliminary assessments of land areas.

"Results of the fertilizer use survey that we conducted indicate that farmers are increasingly using more fertilizer, particularly urea, and improving the efficiency of fertilizer management," Henao says.

The activities and results of the ASF construction and surveys performed have led to a series of recommendations for the maintenance and continued development of agricultural assessment strategies in Albania. Some of these recommendations are as follows:

1. Albania's agricultural sector is undergoing rapid structural changes aimed at sustaining economic recovery. Albania needs reliable information to support these changes; therefore, it is necessary to continue using and improving ASF-based surveys to support the implementation of a national agricultural statistical system in the country.
2. Albania should continue making national-level surveys associated with land areas. These surveys will be very necessary for monitoring crop production and determining land use patterns and farming changes.
3. In the estimation of agricultural areas for evaluating input needs and constraints, greater frequency of surveys based on ASF and more detailed data are needed for major crops than for minor crops. Wheat and maize are the two major crops in Albania.
4. For many crops, national and regional estimates of yields and crop production and input use forecasting do not exist in Albania. The development of techniques based on area frames to evaluate crop growth conditions prior to harvest can be useful in crop management and production forecasting, resource use, and sanitation strategies.
5. To improve future survey efforts for projections and forecasting, Ministry of Agriculture and Food survey data should also be collected and processed using modern techniques in data analysis, crop growth simulation modeling, and geographic information systems. The techniques based on ASF should be specifically designed for preparing production estimates at regional, village, commune, and district levels in the country.
6. In the future, the ASF data surveys, yield projections, crop, and livestock production in Albania need to be linked with socioeconomic and marketing data to monitor changes and provide current supply and demand information to government officers, farmers, and traders.