

Report

*the work & progress at the
International Fertilizer Development Center*

Tosun Laci Grows a Prosperous Enterprise With His Magical Albanian Beans

An Albanian entrepreneur tests the waters of the free market system.

(Photo by Dr. Thomas P. Thompson)



Reminiscent of the famed Old English fairy tale of "Jack and the Beanstalk," whose magical beans brought him wealth, a resourceful Albanian entrepreneur named Tosun Laci has fared well in his agricultural export business, marketing premium quality green beans to the Italian market. Even during the political turmoil of 1997, Laci, who rents 185 ha from smallholder farmers to produce vegetables for the Italian market, fared better than most of his countrymen – exporting approximately US \$900,000 worth of beans, tomatoes, and asparagus to Italy during 1997. During 1998 he expects to double his exports for a gross of US \$1.8 million.

This success story illustrates the impact of a USAID agribusiness project being conducted by IFDC. Laci is one of the beneficiaries of the project, having participated in its agribusiness training programs and business trips to investigate export opportunities.

Today Laci is preparing to begin greenhouse production of fresh vegetables for both domestic and export markets. "Thanks to the Albanian Fertilizer and Agribusiness Dealers' Association (AFADA), I have established good international contacts," says Laci. "My business survived the political turmoil of 1997 and continues to grow."

Prior to becoming an entrepreneur Laci served as an economist at the Agro-Tregtare Enterprise in Lushnja, Albania. As one of the founding members of AFADA, he participated in many business preparatory exercises; he now operates his own agribusiness, which markets fertilizers, pesticides, and other agricultural inputs to farmers. During 1990-96 Laci had 2,000 clients located at 10 selling points, where he employed about 37 employees. In December 1996, he began a joint venture with an Italian company, exporting beans and other vegetables. Laci arranges for the crops to be grown by 120 Albanian families (200 families profit from employment), and the produce is shipped under refrigeration to Italy; whereas, the Italian company provides the technical resources, including seed, and markets the products in Italy. Laci's future plans include extending the joint venture and doubling or tripling the vegetable production.

The project has established that the open market system will work in Albania. The impact of the overall project is that it has assisted in increasing food production, promoted agribusiness development,

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and demonstrated the potential for agricultural development. According to the World Bank, Albania experienced an increase in average annual growth rate in agricultural production of 7.6% during 1990-95, compared with a growth rate of 2.4% during 1980-90. Wheat yields have increased from 2,290 kg/ha in 1994 to 2,890 kg/ha in 1997; maize yields have increased from 1,830 kg/ha in 1994 to 2,880 kg/ha in 1997. A higher percentage of farmers (81.5%) than ever used fertilizer on their crops during 1997. Despite the collapse of the banking system and zero mercantile credit, AFADA mem-

bers obtained US \$3.25 million in credit in 1997. The credit recovery rate from AFADA members is still a remarkable 84%. During the past 4 years, 400 new agribusinesses, employing 4,000 people, have been established.

Albania's Minister of Agriculture and Food, Professor Dr. Lufter Xhuveli has a clear concept of the impact of the USAID-funded project on Albania's agriculture sector during his country's most difficult period – the transition from a centralized economy to a free market economy. He views the project as having promoted in the private sector "clear-sharp models of potential success in agricultural development." In the

public sector, he sees the influence of IFDC in contributing toward the advancement of agricultural science in his country. "The laboratory that was installed in the Soil Science Institute, the gene bank, and the refurbished laboratory in the State Seeds Institute are contributions that will have a great impact on the future development of Albanian agriculture," Xhuveli says. "I think that IFDC's recent steps to support Albania's farmer associations, agribusinesses, and its agricultural publications are clear evidence of a project that aims to meet the challenges of the future." ☉

Success Stories from the Albanian Agribusiness Center (ABC)

Mireli Milk and Cheese Company

Agif Caca, an experienced cheese maker, faced a difficult decision when the state-owned factory where he was employed closed at the demise of Albania's centrally planned economy. He could either escape to a possibly better life in Italy or stay and build a new life and business in the emerging free market economy. Using a meager \$350 inheritance from his father, Caca bought bricks and mortar and built his own milk and cheese plant.

The young Mireli plant faced many difficulties, such as electric power interruptions and spoiled milk. With assistance from the ABC staff, the Mireli plant procured and installed a power generator and pasteurizer and purchased three new refrigerated trucks. The new equipment allowed Mireli to supply the market with fresh milk at the appropriate time and the amount the market requests.

Since 1992 the Mireli factory has doubled in size and the amount of milk processed has increased from 500 liters/day to 10,000 liters/day. Today Mireli is the largest liquid milk supplier in Tirana and delivers to over 100 shops every day.

Shpiragu Jam and Preserve Company

Four Albanian friends – all aspiring entrepreneurs – seized an opportunity to become successful business owners in 1993 by purchasing a formerly state-owned agricultural enterprise in Berat, Albania. The Company also owns about 8,000 fig trees and rents 8,600 olive trees in the Berat area. According to the contracts, the farmers are paid 35% of the amount of production so that the entire harvest is used for processing.

The owners recently decided to expand the business by building a new processing plant and purchasing the necessary equipment for a jam and preserve processing line to produce 120 tons/year. The ABC staff assisted the Shpiragu Company in the design of their new plant and the procurement of equipment. The next step will be to purchase a 2-ton-per-hour steam generator. The operation includes the processing of olives, dried figs, jam, marmalade, preserves (compote), fresh vegetables, pickles, and olive oil. Some of the produce is sold domestically, but most is exported to Eastern Europe.

The efforts of the four Albanian friends have paid off – during 1997 the Shpiragu Company realized a profit of US \$70,963. ☉

IFDC-Africa Assists West African National Governments in Development of Soil Fertility Action Plans

The World Bank-led, multiagency Soil Fertility Initiative (SFI) has been instituted in the shared belief that soil fertility recapitalization, improvement, and maintenance play a crucial role in agricultural growth, poverty alleviation, and environmental protection. The complexity of restoring and maintaining soil fertility in sub-Saharan Africa calls for a holistic approach involving all stakeholders.

As an SFI partner, IFDC collaborates with national governments to create awareness among stakeholders regarding the need for soil fertility improvement and to elaborate national strategies and action plans in several West African countries. IFDC-Africa has been involved recently in a variety of activities related to soil fertility improvement in west and central Africa. Fertilizer sector studies have been executed for Benin, Burkina Faso, Ghana, Mali, Niger, Nigeria, and Togo.

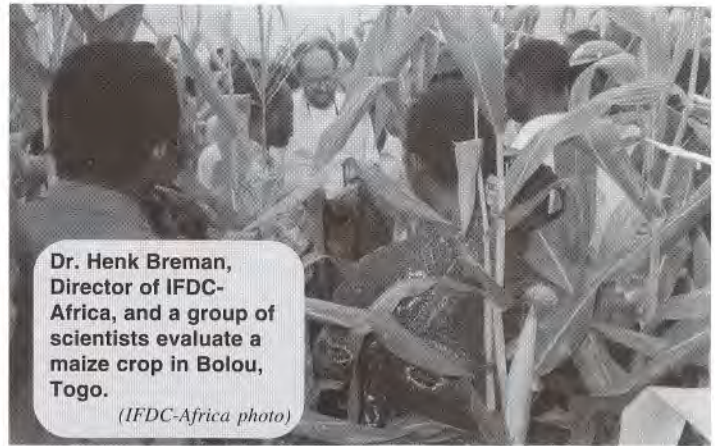
"IFDC's integrated soil fertility management approach involves not only consultations with stakeholders but also links soil fertility improvement to the development of input and product markets," says

Dr. S. K. Debrah, Coordinator of IFDC-Africa's Sustainable Agricultural Production and Market Development Project.

"The approach is illustrated by IFDC's experiences in Burkina Faso, where strong political support manifested through the establishment of a Soil Fertility Management Unit (SFMU): IFDC technical assistance, and Dutch Government funding provided a favorable environment for the elaboration of a national strategy and action plans for the integrated management of soil fertility over a 12-year period."

In Burkina Faso, technical assistance was provided in awareness creation through a series of workshops leading to the elaboration of a national strategy for an integrated management of soil fertility. IFDC is also assisting in the development of a private sector input distribution network to make fertilizer and other agri-inputs more accessible to farmers. IFDC and its partners have adopted an integrated soil fertility management strategy, which maximizes the use of mineral and organic fertilizers facilitated by an environment in which strong political will, policies, and donor support provide an incentive for investments in soil fertility restoration.

Burkina Faso's SFMU was assigned responsibilities for the promotion and creation of awareness at the national and international level of the need to create a favorable environment for investments in soil fertility, elaboration of a national strategy for an integrated



Dr. Henk Breman, Director of IFDC-Africa, and a group of scientists evaluate a maize crop in Bolou, Togo.

(IFDC-Africa photo)

management and restoration of soil fertility in the country, elaboration of action plans to implement the strategy, and coordination at the national level of the country's soil fertility-related activities. The action plans of the national strategy for the integrated management of soils in Burkina Faso focus on the promotion of soil amendments, the promotion of technologies that accompany soil amendments, and the development of input and product markets.

Preliminary contacts have been made for IFDC's technical assistance to the Government of Benin in the area of awareness creation, the conduct of a national conference, and an eventual elaboration of a national strategy for soil fertility improvement. In Cameroon and Sierra Leone, IFDC provided technical assistance in assessing the requirements for establishing a fertilizer quality control regulatory framework.

IFDC has collaborated with scientists and policy makers in Ghana to conduct specific fertilizer sector studies, including studies of the Ghana Fertilizer Privatization Scheme and the effects of the liberalization and privatization of the agri-

input sector. It contributed also to the elaboration of a national action plan. In Togo, IFDC has advised on an agricultural inputs privatization plan, supports the elaboration of a national soil fertility improvement strategy, and is currently collaborating with the government under European Union funding to undertake studies leading to a pilot project on the use of phosphate rock in the coffee, cocoa, and cotton zones.

In collaboration with its partners, IFDC has successfully promoted a greater awareness for the need for soil fertility improvement in the region. It has also demonstrated that a long-term commitment of government policy makers and the international community and a wide participation of all stakeholders is essential to tackle the complex process of soil fertility restoration and improvement. The Burkina Faso experience has shown that with the necessary elements in place – government commitment and investment, technical support, and donor assistance – it is possible to elaborate through consensus a concise strategy for the integrated management of soil fertility. ☺



IFDC-Africa Collaborates with the University of Benin (Togo) on Peri-Urban Vegetable Production Research



During the past 10 years IFDC-Africa has collaborated with the University of Benin in Togo in the joint supervision of students who are enrolled in B.S. and M.S. programs of mutual interest to both institutions.

This year Fred Kouvonou, a sociology student worked with B. Honfoga and Dr. S. K. Debrah on the economics of vegetable production in the Lomé vicinity. The study was undertaken to assess the importance of the dual role of peri-urban vegetable production as a source of regular income and its contribution to food security in the Lomé area.

The results show that the producers, who are mainly immigrants from the rural areas, retirees from civil service, unemployed youth, and women, make a decent living from vegetable production. Net incomes from vegetable production are estimated at about CFA 180,000 (about US \$300) per month, equivalent to the salary that senior civil servants earn in the West African region as a whole. The presence of a ready market and the profitability of vegetable production provide the necessary incentives for the producers to invest in the intensification of the small plots that they cultivate. When organic and mineral fertilizers, improved seeds, water, and hired labor are used judiciously, vegetable production in the Lomé area is a good example of an integrated approach to soil fertility improvement. The primary constraints to increased production are the lack of access to fertilizers and insecure titles to the plots on which vegetables are produced.

The results were presented at an international workshop on urban agriculture's contribution to food security, which was held recently in Ouagadougou, Burkina Faso, under the sponsorship of the International Development Research Centre (IDRC, Canada). Further contacts were made at the meeting for eventual collaboration and networking of all regional stakeholders in the area of peri-urban agriculture.🌐

Phosphate Rock as a Valuable Soil Amendment: Increasing Insight for Use Under African Conditions

A recent thesis by a University of Abidjan student, Komlan Dossa from Togo, compares two forms of phosphate rock (PR) and soluble phosphate (SSP) as sources of phosphorus (P) for common cereal/legume rotations of the West African savannas. Crop residues are recirculated to maintain the organic matter status of the soil. Two soils are compared, one with and one almost without P-fixation. The thesis is based on a research project, covering both the semiarid and subhumid regions, which was conducted in Togo by IFDC-Africa at the request of the University of Hohenheim, Germany.

The current depletion of plant nutrients from soils of agricultural lands that are already endowed with inherently poor soils is an important constraint to rural development in many countries of Africa. In the framework of its Soil Fertility Initiative, the World Bank initiated case studies in three African countries to evaluate the potential of using phosphate rock for soil improvement. The conclusions are not yet unequivocal due to the absence of precise field observations.

Dossa's work at IFDC-Africa shows that the second year after PR is applied, yield increases for cereals and legumes are still negligible on the P-fixing soils. However, on the non-P-fixing soil, a 12% increase in cereal yield has been observed, compared with 35% for SSP.

The role of phosphate rock as a soil amendment may be important to countries in west Africa. Taking the recovery of nitrogen fertilizer as a measure of impact on nitrogen uptake and crop production, nitrogen recovery appeared at least twice as high using SSP rather than phosphate rock on the non-P-fixing soil. On the P-fixing soil nitrogen recovery with SSP compared with that with phosphate rock was substantially lower than on non-P-fixing soils due to the decreased efficiency of SSP. When phosphate rock was the source of phosphorus, the recovery of nitrogen by the cereal crop was similar on the P-fixing and the non-P-fixing soil; in both cases the recovery was low. If phosphate rock's effect on crop yields does not increase considerably in the coming years, PR will only be useful as an amendment if its price is substantially lower than the price of soluble phosphates.🌐



Dr. Zahurul Karim
Executive Chairman
Bangladesh Agricultural
Research Council

(Photo courtesy of BARC)

Chairman of the Bangladesh Agricultural Research Council Visits IFDC

To gain a clearer perspective of IFDC and its programs, the Executive Chairman of the Bangladesh Agricultural Research Council (BARC), Dr. Z. Karim visited the Center's Headquarters' facilities during January 1998.

In an interview with the *Report's* Editor, Karim outlined Bangladesh's agricultural situation and the future of that sector as he sees it. "In Bangladesh, agriculture dominates the economy," Karim says. "In fact, about 31% of the gross domestic product derives from agriculture, and two-thirds of the country's people are involved in this sector."

Bangladesh, according to Karim, has diverse agroecological resources; the country is divided into 30 agroecological regions that are suitable for the production of a wide variety of crops. Rice is the dominant crop; 70% of the total agricultural area is cropped in rice, with 55% of that area covered with modern varieties.

"During 1983/84 Bangladesh produced 11 million tonnes of cereals," says Karim. "Today that figure has nearly doubled; the country now produces 20+ million tonnes. This growth in yields has resulted from increased use of agricultural inputs, particularly fertilizer, and the use of credit."

Karim has a clear understanding of IFDC's impact on his country's agriculture sector. "IFDC facilitated the transfer of fertilizer marketing from the public to the private sector," he said. "As a result, fertilizer is now available at the farmer's door at affordable prices."

Because the fertilizer sector was privatized, the Bangladesh Government saved money; the private sector operated very effectively and efficiently, according to Karim. "IFDC provided strong support in the area of information management and consultation on fertilizer marketing. The Center provided the Government much assistance in many areas."

IFDC's current project in Bangladesh covers the entire spectrum of agribusiness. "IFDC's present project has begun activating the communities working in the agribusiness sector," Karim says. "This

work needs to be expanded to capture the opportunities available through the world market."

The agronomic portion of the project has also captured Karim's attention. "In demonstrations conducted by the Department of Extension in farmers' fields, the benefits accrued from the use of urea supergranules (USG) have been illustrated. On wetland rice 33% of the nitrogen fertilizer applied can be recovered by the plant. This is very important for the Bangladesh rice farmer. We further expect new innovations on fertilizer blending; our farmers want and need improved products. In the future, multinutrient grades will be needed."

There are numerous possibilities for BARC and IFDC to cooperate on a variety of projects, according to Karim. "For example, BARC

maintains a strong data base of crop information and conducts modeling research on phosphate and rice, wheat, and other crops. Jointly the two organizations can work to help provide farmers with the type of technology that is needed for a specific location.

Future joint efforts by BARC and IFDC can enter a new dimension by pursuing a project focusing on smallholder farmers, using their own innovations to sustain agricultural production to integrate the development process in small communities."

Karim looks forward to future joint ventures focusing on research and development activities conducted by BARC and IFDC.⊗

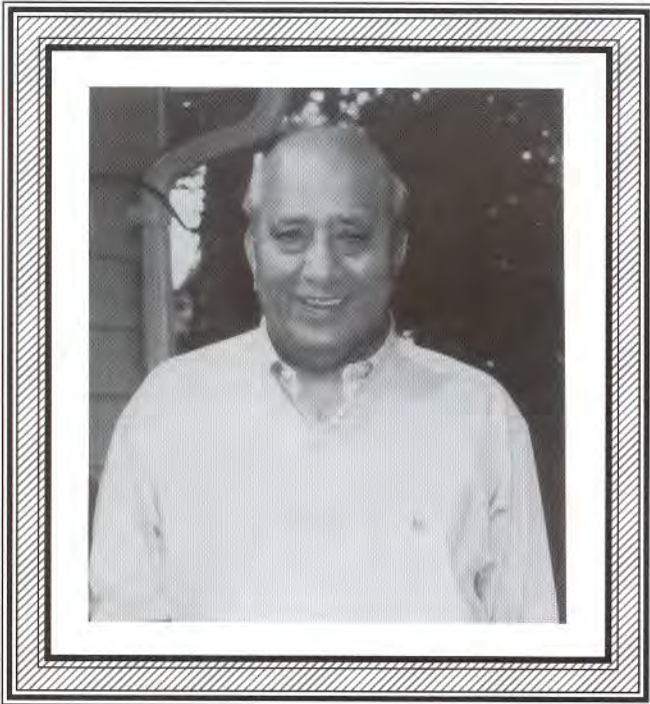


RECENT IFDC PUBLICATION

IFDC recently released a new publication, *Environmental Challenges of Fertilizer Production—An Examination of Progress and Pitfalls, Proceedings of an International Workshop*, which includes the 27 papers presented by industry leaders from throughout the world. This publication results from a workshop, which IFDC conducted during September 17-19, 1997, in Atlanta, Georgia, in cooperation with the European Fertilizer Manufacturers' Association (EFMA), the International Fertilizer Industry Association (IFA), The Fertilizer Institute (TFI), the United Nations Environment Programme (UNEP), and the United Nations Industrial Development Organization (UNIDO). IFDC organized the workshop to provide the fertilizer industry and other stakeholders an opportunity to examine progress made on the environmental front, address problems encountered, and identify the challenges that still must be faced.

Interested parties may order the publication (IFDC-SP-25) from the IFDC Purchasing Department, P.O. Box 2040, Muscle Shoals, AL 35662; Fax: 256-381-7408; e-mail: purchasing@ifdc.org. The price of the publication is US \$60, which includes shipping and handling.⊗

In Memoriam – Ram Sarup Giroti



The Late Ram S. Giroti Former Director of IFDC Human Resource Development

The Director of IFDC's Human Resource Development, Ram S. Giroti, died on April 21, 1998, after suffering a stroke. Giroti led the development of IFDC's training program over the past 19 years. "Ram Giroti's foresight, determination, and hard work were responsible for the worldwide recognition of IFDC's training programs," says Dr. Amit H. Roy, IFDC's President and Chief Executive Officer. "He was the best ambassador of IFDC within the fertilizer sector."

Giroti's contacts in the fertilizer sector, including some 7,000+ IFDC training alumni, are found in more than 140 countries around the globe. Throughout his illustrious career with IFDC, Giroti developed, conducted, and coordinated more than 500 training programs, workshops and study tours in fertilizer marketing, production technology, fertilizer use efficiency, sustainable agriculture, policy options, and the environment. He participated in IFDC training programs in Belgium, Cameroon, England, Guatemala, India, Indonesia, Ireland, Jamaica, Kenya, Malaysia, Mauritius, Netherlands, Philippines, Singapore, South Africa, Sri Lanka, Thailand, Togo, and Germany.

During 1958-78, Giroti held several positions in the Fertiliser Association of India (FAI), New Delhi, India, including Manager of Marketing Services and Training Manager. He was Editor of *Fertilizer Marketing News* and a member of the editorial committee of *Fertilizer News*, both monthly FAI journals. "Giroti left an indelible mark on FAI in whatever portfolio he handled," says IFDC Board Member Pratap Narayan, who is also Director General of FAI.

A native of India, Giroti received a bachelor's degree in economics and a diploma in journalism from Punjab University and a master's degree in business administration from Delhi University. 🌐

Ram Giroti Memorial Scholarship Fund Established

IFDC has established a Ram Giroti Memorial Scholarship Fund to commemorate Ram S. Giroti's life, his impact upon the fertilizer sector in countries around the world, and his influence on the thousands of training participants with whom he had contact during the past 20+ years while he was leading the human resource development programs of IFDC and the Fertiliser Association of India (FAI).

Monies contributed toward this Fund will be used to provide scholarships to aspiring developing-country scientists, engineers, and leaders of the agriculture, agribusiness, and fertilizer sectors who wish to participate in IFDC's global training programs. IFDC Management and staff encourage the many friends, colleagues, collaborators, acquaintances of Giroti, and especially alumni of IFDC's training programs, to contribute to the Fund either individually or as small groups.

Anyone wishing to make a donation to the Ram S. Giroti Memorial Scholarship Fund should make his/her contribution payable to the International Fertilizer Development Center (IFDC) and mark the check "For Ram S. Giroti Memorial Scholarship Fund." Donations should be sent to the Director, Finance and Administration, IFDC, P.O. Box 2040, Muscle Shoals, AL (U.S.A.). For U.S. citizens and institutions, the donation is tax deductible. 🌐

Research Project Evaluates the Effectiveness of Urease Inhibitors in the Philippines and Vietnam



IFDC/IRRI Senior Research Assistant Ernesto Castillo (left) and Visiting FAO Fellow, Dr. A. K. Singh from India, conduct floodwater measurements for the urease inhibitor study in a farmer's field in Victoria (Tarlac Province), Philippines.

(Photo by Dr. Upendra Singh)

Rice is the staple food and the principal crop in Asia. It accounts for 30%-50% of agricultural incomes and provides 50%-80% of the calories consumed by the people. Rice production is most constrained by nitrogen availability to the crop. The common practice of urea application by broadcasting on the soil surface or into floodwater results in 50%-65% losses of applied nitrogen. The use of biological inhibitors to reduce gaseous nitrogen losses (not suitable for preventing runoff losses) and improve nitrogen use efficiency is a relatively simple operation when applied with urea. Urease inhibitors delay the conversion of urea to ammonium-nitrogen, thereby reducing the concentration of ammonium-nitrogen and its subsequent losses from the floodwater. Nitrification inhibitors likewise delay the conversion of ammonium-nitrogen to nitrate-nitrogen, which is prone to losses by denitrification and leaching. Improved use efficiency and yield gains of 10%-26% obtained with inhibitors were similar to those obtained with urea supergranules and polymer-coated fertilizers.

With support from the Australian Center for

International Agricultural Research (ACIAR), IFDC evaluated a number of urease and nitrification inhibitors during a recent 2-year project.

Dr. Upendra Singh, IFDC Senior Systems Modeling (Soil Fertility) Scientist, and Dr. Bernard H. Byrnes, IFDC Soil Fertility Scientist, cooperated with scientists in the Division of Plant Industry of the Commonwealth Scientific and Industrial Research Organization (CSIRO) in Australia; the Department of Soil Science of the Institute of Soils and Fertilizers in Vietnam; and the International Rice Research Institute in the Philippines.

"We investigated the use of the urease inhibitors in the field either alone or in combination with a nitrification inhibitor," Singh says. "The urease inhibitors used were cyclohexyl phosphorictriamide (CHPT) and N-(n-butyl) thiophosphorictriamide (NBTPT). The nitrification inhibitor was encapsulated calcium carbide (ECC), which provides a slow-release source of acetylene, the active inhibitor. Since ECC and CHPT are not commercially available, they had to be synthesized at IFDC Headquarters. Basic studies were conducted at IFDC to develop the methods to produce the

nitrification inhibitor ECC for use in the field studies. To produce a useful material, the acetylene release rates of ECC products when they were incubated in soils were determined."

"Laboratory and greenhouse studies confirmed that the efficacy of the urease inhibitor NBTPT was severely restricted in three out of the four soils from the Philippines by slow formation of the active inhibitor NBPT (2-3 times slower than Guthrie and Crowley soils from the USA), and its rapid decline once formed," Singh says. "NBPT was essentially gone by day 7 in the Philippine soils. The results indicate that in such soils it would be desirable to use active urease inhibitors, such as CHPT. The technique used in our research could delineate whether NBTPT could be used effectively in specific soils."

For all the sites and seasons in the Philippines and in Vietnam the urease inhibitors delayed hydrolysis of urea by 10-20 days compared to the control (urea only). Practically all the urea was hydrolyzed within 5 days of application in the control plots. As a result, floodwater ammoniacal-N in the urease inhibitors treatments did not exceed 4 kg N ha⁻¹ on

any day compared to 15-20 kg N ha⁻¹ in the control plots. These results indicate that inhibitors would effectively reduce N losses.

At sites in the Philippines during the dry season, urease inhibitors and a combination of urease and nitrification inhibitors resulted in significant yield advantage (15%-20%) and improved apparent nitrogen fertilizer recovery (41%-71% vs 24%-39% with urea alone). However, during the wet season, the yields were highly variable with inhibitor applications, ranging from 0% to 22% yield difference compared with control. In Vietnam urease inhibitors resulted in significant yield increases over urea (10%-26%) in both the spring and summer seasons. The poor/variable response of inhibitors could be attributed to increased incidence of runoff N losses during the wet season. The significant yield gains and comparable performance of urease and nitrification inhibitors versus deep-point placed urea supergranules (-8% to 23% difference) during the dry season make the urease inhibitor technology highly viable.

The success of urease inhibition is dependent on the commercial production of CHPT, either with or without NBTPT. No definite conclusion on the effect of ECC was made, hence more greenhouse research is needed to identify the effects of ECC on denitrification losses, growth of rice, and pathogens. Future field studies should

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consider the effects of transplanting shock with urease inhibitor application on various soils – it is hypothesized that N savings from inhibitors would be much higher with greater transplanting stress – as in typical farmer conditions. Future modeling efforts would be directed toward testing the CERES-Rice model with existing data from inhibitor experiments.

“Additional studies are required to determine whether the urease inhibitor CHPT or NBTPT in combination with a nitrification inhibitor will improve the efficiency of fertilizer nitrogen for upland crops such as wheat, rice, and maize,” Singh says. ☉

New Fertilizer Manual Released



IFDC and the United Nations Industrial Development Organization (UNIDO) recently released the Third Edition of the *Fertilizer Manual*, which was published by Kluwer Academic Publishers.

This new, fully updated, comprehensive reference on the technology of fertilizer production contains 22 chapters on fertilizer use, production, and distribution economics, raw materials, and the status of the fertilizer industry with demand-supply projections. Also included are engineering flow diagrams and process requirements for the primary fertilizer processes including ammonia, urea, phosphates, potassium products and many others. Environmental considerations are addressed clearly. Professionals involved in any phase of fertilizer production, marketing, distribution, or use will find this book valuable.

The publication of this edition of the *Fertilizer Manual* is especially timely in that the World Food Summit, which was held in 1996, discussed the global challenges created by a burgeoning population, shrinking land area available for food production, and mounting food insecurity. The United Nations forecasts that agricultural output must be tripled if the 8.5 billion population of the world of 2025 is to be fed; with increasingly limited land under cultivation, sustainable food security cannot be achieved without the benefits of intensified agriculture – the key to alleviating poverty.

The last revision of the *Fertilizer Manual* was published in 1979. Since that time outstanding advances in fertilizer technology have occurred whereby more energy-efficient processes and reductions in the cost of production have resulted. This edition of the *Fertilizer Manual* provides planners with information on these new advances.

Interested parties may obtain a copy of the *Fertilizer Manual* (IFDC-R-11) by placing an order with the IFDC Purchasing Department, P.O. Box 2040, Muscle Shoals, AL 35662 (U.S.A.); e-mail: purchasing@ifdc.org; or fax: 256-381-7408. The price of the publication is US \$60.00 for U.S. addresses and US \$75.00 for non-U.S. addresses; the price includes shipping and handling. ☉