

# IFDC

*A QUARTERLY MAGAZINE*

IFDC's First Decade –  
Research and Technology Transfer

KAED Builds Kyrgyz Livestock  
Sector With Improved Breeds

DSSAT Training for Fertilizer  
Recommendations

2SCALE: A Diverse Approach  
to Agribusiness in Africa

Virtual Fertilizer Research Center  
Creates Research Protocols



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IFDC is a public international organization, governed by a board of directors with representation from developed and developing countries. The nonprofit Center is supported by various bilateral and multilateral aid agencies, private foundations and national governments. IFDC focuses on increasing and sustaining food security and agricultural productivity in developing countries through the development and transfer of effective and environmentally sound crop nutrient technology and agribusiness expertise.

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**FREQUENTLY USED ACRONYMS**

**2SCALE:** Toward Sustainable Clusters in Agribusiness through Learning in Entrepreneurship  
**AAPI:** Accelerating Agriculture Productivity Improvement in Bangladesh  
**ABCs:** agribusiness clusters  
**AFAP:** African Fertilizer and Agribusiness Partnership  
**DGIS:** Directorate-General for International Cooperation  
**DHF:** demonstration host farmer  
**DRC:** Democratic Republic of the Congo  
**DSSAT:** Decision Support System for Agro-Technology Transfer  
**ECOWAS:** Economic Community of West African States  
**EDF:** Economic Development Fund  
**FAO:** Food and Agriculture Organization of the United Nations  
**FDP:** fertilizer deep placement  
**FTF USAID ATT:** Feed the Future USAID Agriculture Technology Transfer  
**GHG:** greenhouse gas  
**ha:** hectare  
**IFAD:** International Fund for Agricultural Development  
**ISFM:** integrated soil fertility management  
**K:** potassium  
**KAED:** Kyrgyz Agro-Input Enterprise Development  
**kg:** kilogram  
**MDG:** Millennium Development Goal  
**MIR+:** Marketing Inputs Regionally Plus  
**MIS:** market information system  
**mnt:** million metric tons  
**N:** nitrogen  
**NARES:** National Agricultural Research and Extension Systems  
**NFDC:** National Fertilizer Development Center  
**P:** phosphorus  
**PO:** producer organization  
**PRReFER:** Privatization of Rwanda's Fertilizer Import and Distribution System  
**PROFIT+:** Production, Finance and Improved Technology Plus  
**RECs:** regional economic communities  
**SSA:** Sub-Saharan Africa  
**TVA:** Tennessee Valley Authority  
**UEMOA:** West African Economic and Monetary Union  
**USAID:** U.S. Agency for International Development  
**USAID WAFP:** USAID West Africa Fertilizer Program  
**VFRC:** Virtual Fertilizer Research Center



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## The Year of Family Farming

The United Nations has declared 2014 the International Year of Family Farming. An estimated 500 million family farms around the globe, relying on non-wage, family-member labor, represent approximately 80 percent of all farm holdings, and produce roughly 70 percent of the food supply in the developing world. In partnership with the International Fertilizer Industry Association (IFA), IFDC is participating in a worldwide campaign to bring recognition and support to these smallholder farming families. Throughout the year, IFDC will bring to light these dedicated agricultural producers with stories of success through access to new technologies, training, professionalization and market linkages. For more information, visit [www.ifdc.org](http://www.ifdc.org) or IFA at [www.fertilizer.org](http://www.fertilizer.org).

▼ On the cover: A Malian woman and her daughter sell potatoes at a local market in West Africa.

For 40 years technology transfer has been foundational to IFDC's efforts.

# Reflecting on Our Four-Decade Milestone

*Traditionally, reaching a historical landmark evokes a desire to examine the successes of one's past and causes one to look forward to equally meaningful endeavors in the future. Such is the case as I look back over IFDC's 40 years of service in efforts to achieve global food security while enhancing the lives of billions of smallholder farmers.*

Upon its birth in 1974, IFDC held firmly to its mission to continue the development of new fertilizer and agricultural production technologies championed by the National Fertilizer Development Center (NFDC) in previous decades under the United States' Tennessee Valley Authority. Early IFDC efforts focused in South America and Asia, particularly to address low nitrogen use efficiency in rice production in some countries. In less than two decades, many of these developing nations became food secure. From there, IFDC's influence

and interventions spread nearly the world over – Eastern Europe, the Middle East and Africa – teaching best agricultural practices, providing access to new fertilizer technologies and providing technical assistance to private industry.

Evolution has been an IFDC mantra throughout its history, and transformation has led the Center to grow beyond fertilizer development and technology transfer to something altogether greater in its depth and scope. Today, the Center is a renowned expert in creating and enhancing national and regional inputs supply chains and linking smallholder farmers to well functioning and profitable output markets. IFDC has developed robust expertise in building agriculture-related economies in emerging markets – all the while focusing on plant nutrient management, pro-agriculture policy, public-private partnerships and professionalizing smallholder farmers.

But in the midst of these achievements, we must resolve to contemplate the future of food security. The challenges are greater

than ever, and the stakes grow higher with each passing year. IFDC believes that innovation will write the next chapter of this story. Advances in fertilizer technology will be critical in the quest to feed nearly 10 billion people by 2050. We are at a unique point in history, much like the industrial revolution of the mid-1800s, where we have – or soon will have – the tools to protect the environment, to resist and react to climate change, to increase nutrient use efficiency and to improve human health.

Throughout the year, IFDC will commemorate the Center's accomplishments by taking time in each of our four IFDC magazine issues to explore the Center's evolution throughout each decade. We will also explore several of the issues and opportunities that we face in future development efforts. I hope that this will not only be an engaging historical review but also an inspiration for future work by IFDC and others in international agricultural development.

*Amit Roy*



## IFDC's First Decade: *Success Through Agricultural Research and Technology Transfer*



- ▶ IFDC's first decade was defined by technology transfer missions consisting of a few staff members sharing knowledge with farmers.
- ▶ Opposite: NFDC staff prepare a demonstration plot.

*The tradition of IFDC's mission stretches much further back than the Center's actual creation. In 1933, the U.S. Congress chartered the Tennessee Valley Authority (TVA) to provide navigation, flood control, electricity generation, fertilizer*

*manufacturing and economic development in the Tennessee Valley, a historically underdeveloped region in the southeastern United States that held the capacity to greatly contribute to the nation's depressed gross domestic product (GDP) at the time.*

**“The United States urges the establishment of an international fertilizer institute as part of a larger effort to focus international action on ... improving the effectiveness of chemical fertilizers ... and new methods to produce fertilizers from nonpetroleum resources.”**

**– Henry Kissinger, 1974**

Over the course of the next 30 years, TVA's Office of Agricultural and Chemical Development (OACD), headquartered in Muscle Shoals, Alabama, worked to improve agricultural conditions not only in the Southeast but also in the rest of the U.S. farming sector through revolutionary fertilizer research and market development and distribution systems. Over time and as national needs changed, the OACD became the NFDC. At the height of its research and development (R&D) efforts, NFDC employed some 450 scientists including chemical, mechanical and electrical engineers and other scientific support staff (agronomists, economists, etc.). The contributions of these committed professionals were substantial – nearly 70 percent of the fertilizers in use around the world today were developed by this single team in an unassuming small town, in an equally unassuming southern U.S. state.

By the early 1960s, international recognition of the Center's success led to requests from the U.S. Agency for International Development (USAID) and other organizations for NFDC to actively participate in fertilizer-related problems in least developed countries (LDCs). As successes and subsequent requests increased, NFDC developed an international fertilizer development staff that quickly became “the main source of fertilizer knowledge and expertise available to the U.S. foreign aid programs.”

For NFDC, it was all about technology transfer from the late 1940s to the early 1970s, with small two-to-four-person teams traveling to Venezuela, Pakistan and countless other developing nations, training a team of technicians or reviewing a fertilizer plant's efficiency. These teams did everything from streamlining a fertilizer plant's production and market development to teaching individual farmers best fertilizer practices. On at least a few occasions, a solitary staff member would be given a long-term assignment, such as a chemical engineer assigned to a four-year stint as a regional fertilizer expert in Latin America. However, because of TVA's charter – to serve the needs of the United States – the international fertilizer development staff had a limited amount of freedom; almost every activity was required to flow through USAID under contract. But regardless of that restriction, NFDC was in high gear by the early 1970s, and no other center was better prepared than they to confront the food and oil crisis that began in 1973.

It was then, when the alarming food and fertilizer shortages swelled requests to the NFDC, that the international political and development community took notice of the global fertilizer situation and its relation to food security and peace among nations. Because of TVA's charter, the NFDC was not enabled to tackle such a global crisis. Fortunately, many forward-thinkers from the NFDC such as Dr. Donald McCune and Dr. Paul Stangel – along with other mission-minded





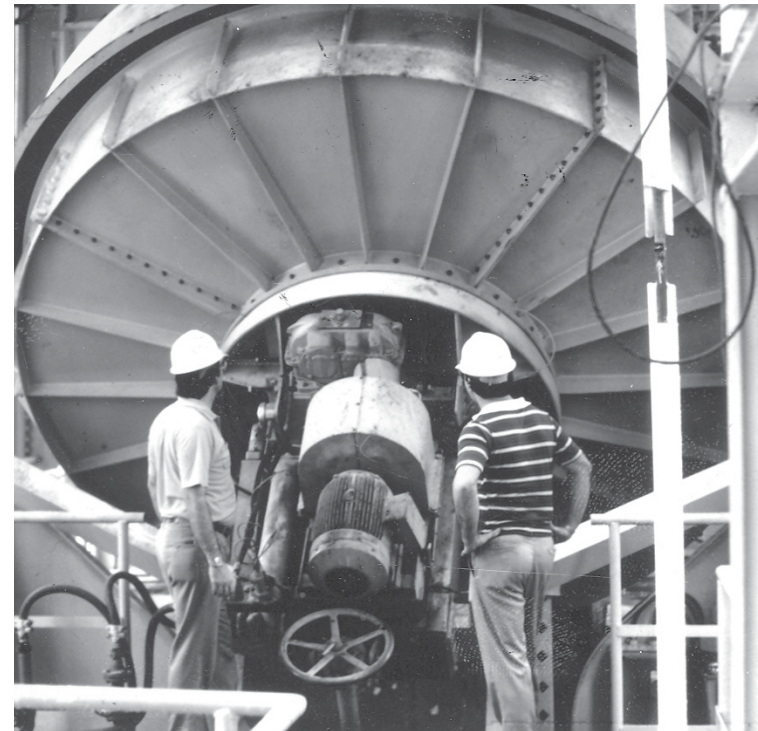
individuals from USAID and other institutions such as Joel Bernstein, John Malcolm, John Hannah and Sir John Crawford – combined efforts to ‘fast track’ a fertilizer development and technology transfer solution – one that had been steeping in their minds and the subject of rigorous conversation and planning that began years earlier. This idea resulted in then U.S. Secretary of State Dr. Henry Kissinger announcing to the world in a speech to the United Nations General Assembly that the United States was prepared to support an international fertilizer research center; by October of that same year, the International Fertilizer Development Center (IFDC) received its first check from the International Development Research Centre (IDRC) of Canada, followed shortly after by a similar commitment from USAID.

To say that the beginnings of IFDC were strongly influenced by NFDC is, to those who know the Center’s success, to tell the story of IFDC’s first decade. Nearly the entire former NFDC staff, headed by Dr. McCune, constituted the whole of IFDC’s new staff. With these dedicated individuals came the spirit that exponentially increased NFDC’s (and IFDC’s) international calls; they dedicated themselves to global food security, focusing on smallholder farmers and sharing the wealth of agricultural knowledge that the scientists of NFDC had compiled since TVA’s inception in 1933.

Unlike some institutions mired in complicated agendas of the day, IFDC was fleet-footed in its first decade. By early 1975, IFDC conducted its first international training with a group of

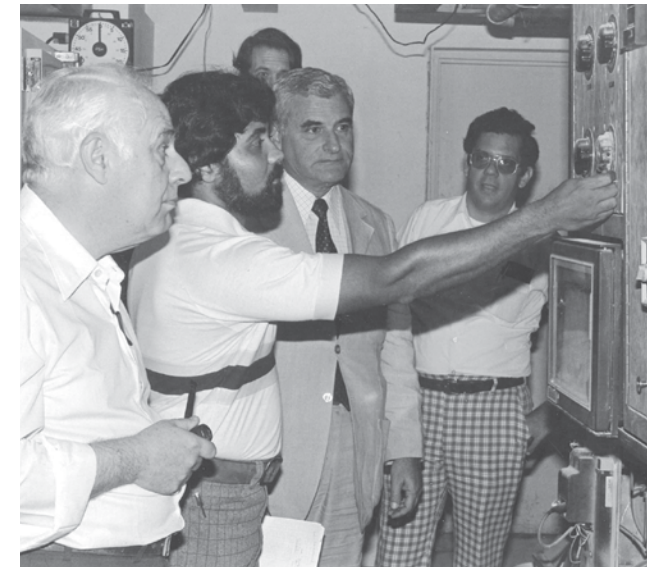
Bangladeshi engineers in Muscle Shoals, and by 1976, other staff members had traveled to 30 countries in Africa, Asia and Latin America. From the beginning, IFDC focused, in addition to research, on training and technology transfer for both large farms and smallholders as the quintessence of its contribution to global food security; the Center’s success in the first decade was fueled by these formal and informal training programs.

Without these strong outreach programs, new technologies had no way to reach the smallholder farmers and fertilizer engineers struggling against a global food crisis. Research and technology transfer operates in symbiosis; one is simply ineffective without the other. As such, IFDC continued the NFDC research studying the effectiveness of fertilizers in the tropics and sub-tropics, and the best way to build knowledge of and access to these new technologies by the smallholder farmers in those regions. IFDC’s technology transfer efforts did not take away from its research efforts early on, for it was in this decade that great strides were made in understanding the pathways to nitrogen (N) losses in cereal cropping systems, mainly rice, and the efficacy of directly applied indigenous phosphate rocks. This new knowledge helped the engineers to develop new fertilizers and/or application methods that would enhance the uptake

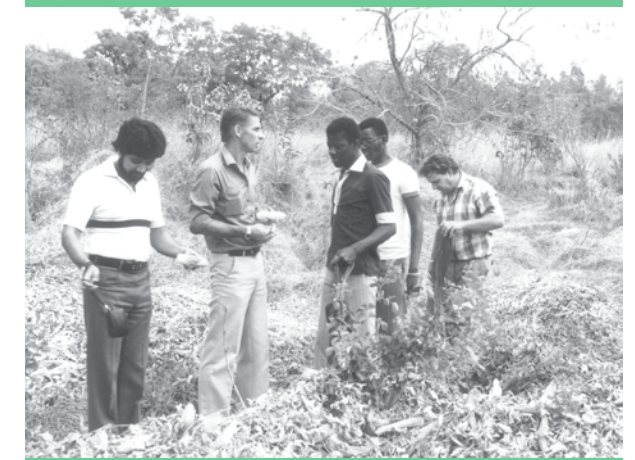


of nutrients by plants. In the first years, three divisions worked in unity to accomplish the Center’s goals: the Technology Division, the Agro-Economic Division and the Outreach Division. Each pursued separate but equal goals and contributed to interdisciplinary task teams that acted as advisory groups on research directions for specific program areas.

But change, or rather evolution, is inevitable. By the end of 1984, a new set of problems plagued the world. Famine began to spread across much of sub-Saharan Africa (SSA). Communism, once strong in Central Asia, lost force and finance, pulling economic support from struggling countries such as Albania and Romania. These and other global instabilities called for a new look at IFDC’s activities and the forms they took, and IFDC geared up for market- and nation-building campaigns that would forever change the way that sustainable international agricultural development is viewed.



- ◀ *Opposite top: NFDC developed some of the first high-analysis fertilizers to combat nutrient mining worldwide.*
- ◀ *Opposite bottom: IFDC personnel inspect a granulation unit at a fertilizer plant in Indonesia.*
- ▶ *Above: Dr. Amit Roy, then special projects engineer, guides visitors in the facilities at IFDC.*



## *A Legacy of Technology Transfer*

Transfer of technology has been one of IFDC’s specialties for 40 years. It continues to drive the Center today as part of IFDC’s holistic market development solutions. Creating global sustainable agriculture requires such technology transfer, and IFDC’s endeavors – as seen in Albania and Bangladesh – build a strong case for success. In the past 40 years, IFDC has held more than 700 formal workshops, study tours and training programs for over 11,000 participants from over 150 countries. Training for dealers and other stakeholders has helped millions and increased food security worldwide. As new and improved agricultural technologies and approaches come to fruition, IFDC will continue to stand on the front line, training technology transfer agents, market specialists, agro-dealers and smallholder farmers alike, bringing us one step closer to a food-secure world.

# Timeline of IFDC's First Decade

## 1974 – IFDC is created.



In 1974, of the world's 4 billion inhabitants, at least 500 million could not conceive a time that they might be able to eat more than a spoonful of rice per day. Famine, drought, poor agricultural practices and a lingering fuel crisis had severely impacted food security. In April 1974, U.S. Secretary of State Henry Kissinger addressed the United Nations General Assembly, proposing an international effort supported by the United States, Canada and other partners to improve agricultural production for developing countries through access to and the proper use of improved fertilizer technologies. The idea was met with ready acceptance. With funding from Canada's IDRC and USAID – and land contributed by TVA in Muscle Shoals, Alabama – IFDC was created.

Until permanent facilities were completed, IFDC operated in temporary offices in a bank building and a small TVA laboratory building (see photo). Bench-scale phosphate rock beneficiation facilities were set up in a former medical laboratory and even a small granulation pilot plant was located in a garage that formerly housed an ambulance.

## 1974 – Dr. Donald McCune (1925-2011) is appointed as the organization's first managing director.



During his tenure at IFDC (1974-1990), McCune, a primary organizer of IFDC, guided the Center as it grew from a research and development organization to an agricultural market development center. McCune received many honors during his distinguished career. Among them were The Francis New Memorial Medal from The Fertiliser Society of London and the National Public Service Award, presented by the American Society for Public Administration (ASPA).

## 1975 – IFDC holds its first specialized training workshop.



IFDC's first specialized training workshop was a Fertilizer Factory Maintenance Course that provided instruction to a team of nine Bangladeshi engineers. To date, IFDC has held nearly 700 workshops, study tours and training programs for over 11,000 participants from 150 countries. IFDC helps build human capacity because knowledge and skill are necessary in the efforts of developing and transitional countries to meet the challenges of privatization, globalization and market development.



## 1975 – IFDC provides its first technical assistance to Latin America.



In 1975, IFDC scientists provided assistance in developing a preliminary strategy for the expansion of a fertilizer manufacturing facility in Barranquilla, Colombia. The IFDC scientists gave production facility operators recommendations on improving operating efficiency, which led to an increase in the facility's output that was much nearer to its design capacity.

## 1976 – IFDC's first intervention in Africa takes place in Ghana.



Don Waggoner, a chemical engineer and later director of IFDC's Outreach Division, trained the staff

of the Ghana Fertilizer Company and helped it prepare for and receive the first shipment of bulk fertilizer at the Port of Tema, near Accra. The shipment demonstrated the technical and economic benefits of shipping fertilizer to that port.

## 1976 – First African appointed to the IFDC board of directors.



In early 1976, Moise Christophe Mensah became the first African appointed to the IFDC board of directors. At the time of his appointment, Mensah was vice chairman and executive secretary of the Consultative Group on Food Production and Investment in Developing Countries and held positions within the government of Benin; he was also regional director for the Food and Agriculture Organization (FAO) of the United Nations stationed in Accra, Ghana. Mensah served on the IFDC board from 1976 to 1978.

## 1977 – U.S. President Jimmy Carter designates IFDC as a Public International Organization (PIO).



“As a public international organization, IFDC became truly international in composition, financing and operation,” said Dr. Amit Roy, IFDC president and CEO. “The designation has contributed greatly to the Center's success over the years.” Under U.S. law, the designation allows IFDC to receive widespread support, cooperation and backing from the world community it was created to serve. As a PIO, IFDC is entitled to the privileges, exemptions and immunities conferred by the International Organizations Immunities Act in the United States.

## 1977 – IFDC begins its first project in Bangladesh, the Fertilizer Distribution Improvement (FDI) project.



Funded by USAID, the FDI project was implemented to assist the Bangladesh Agricultural

Development Corporation (BADCO). The FDI project helped improve the agency's fertilizer warehousing, transportation and distribution systems. IFDC then conducted a fertilizer equity study for the government of Bangladesh that determined that collectively, the country's smallholder farmers purchased the majority of the fertilizer used in the country. A follow-on project, FDI-II, helped to privatize fertilizer marketing in Bangladesh and was the prototype fertilizer market development project that has been adapted and used in a number of other IFDC projects around the world.

### 1977 – Construction of IFDC headquarters is completed.



In 1977, construction of IFDC's headquarters was completed on a 30-acre tract of land made available by the TVA. With nearly 70 staff members already aiding over 40 countries in Africa, Asia and Latin America, the organization was divided into three wings within the headquarters building: the Technology Division, which performed research on various nitrogen (N), phosphorus (P) and potassium (K) fertilizer technologies; the Agro-Economic Division, which focused on fertilizer market and policy research to aid developing countries in attaining more accessible inputs; and the Outreach Division, which worked in the field to test

and implement research conducted at headquarters. All three divisions contributed to interdisciplinary task teams that acted as advisory groups on research directions for specific program areas.

### 1978 – IFDC Pilot Plant begins operations on the IFDC campus.



Completed and made operational in 1978 on the IFDC campus, the pilot plant complex includes three granulation plants, two phosphoric acid plants and one fluid fertilizer unit. Since 1978, the pilot plant has conducted more than 1,600 tests to research the properties and production feasibility of various fertilizer materials.

### 1979 – IFDC finishes its first NPK study in Africa.



In 1977, IFDC began research in Senegal on the effects of NPK – both singularly and in combinations – on two staple food crops in West Africa, millet and groundnuts. Food production there had not increased significantly since 1960, which

correlated with extremely low use of fertilizer. In 1979, agronomists from IFDC and the Societe de Developpement et de Vulgarisation Agricole (SODEVA) of the government of Senegal found that if fertilizer use was increased by only 20 percent nationwide, an additional 81,000 metric tons of millet could be produced.

### 1980 – Case Study: IFDC's Impact on Bangladesh.



In 1980, the country's rice production stood at 10 million metric tons (mmt) harvested from 10 million hectares (ha). By 2009, production had increased to more than 34 mmt from the same 10 million ha. Since IFDC has been in Bangladesh, the country, only slightly larger than the U.S. state of Alabama, has become the fourth-largest rice producer in the world. The Bangladesh Department of Agricultural Extension (DAE) attributes this dramatic increase in both quality and quantity of rice yields to "modern technologies developed by research organizations and effective agricultural extension services of the DAE." Today, IFDC focuses on a broad spectrum of activities in Bangladesh related to advanced input technologies, such as fertilizer deep placement (FDP), soil nutrient management and resource

conservation. IFDC also continues to emphasize the development of sustainable agricultural production systems for long-term food security, with a focus on increased crop yields and greater economic returns to Bangladeshi farmers.

### 1981 – The IFAD project, one of the most important in IFDC's first decade, begins in Niger and Nigeria.



The project, funded by the International Fund for Agricultural Development (IFAD), focused on increasing food production through more effective integrated nitrogen and phosphate fertilizer application in both the semi-arid and humid tropics of Africa. The IFAD project showed African countries how they could use moderate amounts of phosphate fertilizer produced from local resources to increase crop yields. In Gobery, Niger, for example, phosphate rock application increased yields of millet (a food staple in West Africa) to 280 percent above yields produced in plots where no phosphate fertilizer was applied.

### 1982 – IFDC selected to serve as Executing Agency of the African Center for Fertilizer Development (ACFD).



The ACFD mandate was to improve and stabilize African agriculture through proper production techniques and wider use of fertilizers by maximizing the use of indigenous materials and resources. IFDC was selected to execute planning, formation, implementation and operation of the Center, which was successfully established in Zimbabwe in 1987.

### 1983 – IFDC conducts extensive fertilizer research in India.



IFDC scientists conducted extensive experimentation with urea, FDP, potassium nitrate, ammonium nitrophosphate and diammonium phosphate (DAP) on sorghum crops during the rainy season at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in India. The research

was conducted to evaluate nutrient losses from denitrification and leaching in various fertilizer products under different fertilization techniques: point placement, banding and broadcasting.

### 1984 – People Profile: Travis P. Hignett (1907-1989).



A distinguished chemist, chemical technologist and developer, author and administrator, Hignett received global recognition for his many accomplishments in the fertilizer industry over the course of his career. After 35 years at TVA, Hignett served as a special consultant to IFDC for more than a decade. Often referred to as the "Father of Fertilizer Technology," Hignett held 15 patents and was the author of more than 150 publications. He received numerous awards, including The Francis New Memorial Medal from the Fertiliser Society of London. In 1994, IFDC dedicated its library as the Travis P. Hignett Memorial Library in honor of his work and accomplishments in the agricultural field. IFDC commemorates his dedication to fertilizer technology development by hosting the Travis P. Hignett Memorial Lectures, which cover a wide range of agricultural development issues.

Kyrgyz livestock breeders stand with Black Angus cattle imported from the United States. This is the first time that cattle have been flown from the United States to Kyrgyzstan.



## KAED Builds Kyrgyz Livestock Sector with Improved Cattle Breeds

*The livestock industry in the Kyrgyz Republic has always been a leading contributor to the nation's economy, historically contributing through high-value food production, employment and foreign exchange in the form of milk, beef and beef product exports. But this ceased to be the case once the nation separated itself from Soviet rule, according to Maksatbek Mamytbekov, IFDC's KAED project livestock specialist for IFDC's Kyrgyz Agro-Input Enterprise Development (KAED). "After Kyrgyzstan gained its independence in 1991, during the transition period, the livestock and breeding sectors underwent negative changes that led to a reduction in the number of cattle, a rapid decline in the quality of breeds and a measurable decrease in productivity," noted Mamytbekov. Lack of access to financing and other value chain support further contributed to stunted sector productivity. In recent*

*years, IFDC has begun to effect substantial change in these circumstances, laying the groundwork for a sustainable transformation in the sector. The introduction of better breeds and state-of-the-art equipment is moving the Kyrgyz cattle industry into a position to increase domestic and export sales, raise quality standards and guarantee positive economic growth.*

"Beef is a prospective sector for Kyrgyz agriculture, as there are many natural pastures that can be used for cattle raising," said IFDC's Economic Development Fund (EDF) III coordinator, Begler Aslanov. "And at the same time, there is growing demand from neighboring countries and members of the Customs Union for high-quality beef." According to FAO, approximately 48 percent of the country's land, nearly 9,257 ha, is permanent meadow and pasture land. Industry growth is focused on improving the health and production of the animals in the form of genetic improvement and increased milk and meat productivity while optimizing the use of available natural pasture land resources. "Improved bovine breeds, modern and more efficient



- ◀ *Opposite top: Flying first class: 235 heads of cattle experience comfortable accommodations aboard a large U.S. cargo airplane bound for Kyrgyzstan.*
- ◀ *Opposite bottom: Cattle en route from the U.S. to Kyrgyzstan.*
- ▼ *Below: Nine Kyrgyz livestock breeders have been selected to receive KAED-sponsored feed production machinery, cattle maintenance, milking and insemination equipment and improved cattle breeds.*

“Brown Swiss and Brown Swiss/Alatau cross-breeds adapt quickly to the climatic conditions in Kyrgyzstan,” Mamytbekov says. “They also produce an average of 20 liters of milk per day, while local cows barely produce 15 liters per day. The best cows of a herd can produce even more than 30 liters per day.”

Among the 235 imported U.S. breeds were 220 Black Angus pedigree heifers, 11 Black Angus pedigree bulls and two each of Simmental and Brown Swiss pedigree bulls. Black Angus breeds are prized for their high-quality meat and size. Well attended Black Angus cattle will reach 450 to 500 kilograms (kg) in 15 months, while local breeds will reach only 350 kg on average. Black Angus and Brown Swiss heifers and bulls are also valued for their easy acclimation to the Kyrgyz weather and their tolerance for sparse vegetation on pastures. The cattle were delivered to five quarantine locations at select beneficiary farms in Issyk-Kul, Talas, Naryn and Chui oblasts in the north of the country. The KAED team and the Veterinary Inspectorate of Kyrgyzstan are closely monitoring the animals, and KAED has provided appropriate winter feed, minerals and nutrients to the farms holding the cattle in order to ease the transition and ensure proper acclimation through the winter.

The EDF Phase III program and KAED team will continue to guide the beneficiary farms, implement modern technologies and support genetic improvement through artificial insemination in order to establish viable livestock breeders over the next quarter.

### Cattle on a Plane

The most recent initiative of EDF III was the inaugural delivery of 235 heads of cattle, flown from the United States to Kyrgyzstan. IFDC agribusiness market development specialist, Ian Gregory, was one of several coordinators of the massive effort. “IFDC does a lot of things that are innovative and are done for the first time. This is the first time livestock have been exported from the U.S. to Kyrgyzstan,” Gregory stated. Because Kyrgyzstan is a landlocked country, transport of the cattle by cargo airplane was considered to be the most efficient, and offered the least discomfort to the bovine travelers.

Traditional Kyrgyz cattle breeds, Alatau and Auliati, are small, inferior producers, according to Mamytbekov, so the widespread introduction of proven high-quality breeds was critical to the program’s success. In addition to the most recently imported breeds, the initiative previously transferred 156 heads of cattle, including 120 Brown Swiss/Alatau cross breed open heifers, 30 inseminated heifers and six Swiss/Alatau bulls sourced from commercial breeders in the north of the country to the smaller breeders/producers of southern Kyrgyzstan.

methods of artificial insemination, improved care for calves and cattle and additional advancements in raising livestock will improve the Kyrgyz economy and the lives of its citizens,” Aslanov stated.

The USAID-funded and IFDC-implemented KAED Follow-On project EDF Phase III, launched in late 2013, is assisting the sector in this effort to increase the productivity and profitability of livestock farming in Kyrgyzstan. EDF III is importing high-performing cattle breeds and upgrading production systems, equipment, herd genetics and management systems for nine professional and competitive livestock farms selected by the Ministry of Agriculture and Land Reclamation of the Kyrgyz Republic as well as a State Breeding Station. The selected farms will serve as model livestock operations, laying the foundation for a mass transformation in the livestock sector.

At a hand-over ceremony in Novopokrovka village, Chui oblast, Kyrgyzstan, in December 2013, President Almazbek Atambaev of the Kyrgyz Republic and other government officials joined U.S. Ambassador Pamela Spratlen and USAID representatives for the unveiling of nearly 400 pieces of agricultural machinery and equipment delivered to selected livestock breeding farms. Included were tractors, combines, irrigation hardware and milking equipment, in addition to U.S. \$135,000 worth of semen production and insemination equipment. This \$8.5 million grant, provided by

USAID through the EDF III component of KAED, will contribute to the modernization of the Kyrgyz livestock industry into a professionalized and well-linked sector capable of producing high-quality and safe milk and beef products for distribution to domestic, regional and international markets. The EDF III initiative also supports the lives and efforts of those other than farm owners, specifically the farm employees, by introducing new employment opportunities along with training in



modern technologies that simplify their labor efforts and allow them to be more efficient and effective. Similarly, all other participants along the livestock value chain will see benefits from these changes in the sector.



# Vegetables: Key to Nutrition Security in Bangladesh



*Bangladesh has one of the highest rates of malnutrition in the world, according to FAO. For the women of Bangladesh, malnutrition is a particularly devastating affliction, as nutrition-related health issues are almost always passed to their offspring. More than half of pre-school age children, roughly 9.5 million, are stunted and underweight. These undernourished children, if they survive past age five (46 percent do not), are highly susceptible to health-related issues and poor psychological development that will affect them for a lifetime.*

For maximum health and development, the human body requires around 16 primary, secondary and micronutrients, sufficient vitamins and quality calories, much of which, namely Vitamin A, iron and zinc, are missing from the average Bangladeshi diet. Nutritious calories are often unavailable or too expensive for the 70 percent of the nation's population that lives in rural, poverty-stricken areas. According to FAO, Bangladeshis consume about 2,250-2,500 calories a day; while this is sufficient to avoid starvation, about 1,700 of those calories come from rice, which does not contain a vast array of vitamins and minerals. As little as 126 grams (g) of fruit and vegetables, on average, are consumed daily – far below the minimum 400 g recommended by FAO and the World Health Organization (WHO). Exclusive of other foods, these primarily rice-based diets are fueling a 'hidden hunger' epidemic.

Compounding the issue is the fact that rice is high in phytates, a compound found in grains and seeds that binds to nutrients like zinc, magnesium, calcium and iron, and prevents their absorption. Zinc deficiency is the fifth leading cause of death and disease (particularly diarrhea that leads to extreme dehydration) in the developing world, according to WHO, claiming the lives of roughly 450,000 children under age five each year. In a case study published by Cornell University, author Angela Mwaniki reports that 70 percent of women in Bangladesh have an iron deficiency, as do about half the nation's children, resulting in chronic low energy, overall ill-health and premature death.

To help end this cycle of nutrition insecurity, IFDC's USAID-funded Accelerating Agriculture Productivity Improvement (AAPI) project and the Walmart Foundation began working with women farmers in 2013 to increase fruit and vegetable production – an activity that both increases nutrition for rural Bangladeshi families and, because horticulture is an area of farming considered to be solely the domain of women, also contributes to gender equity in the country.

AAPI and Walmart are training 40,000 women in the use of FDP in fruit and vegetable crops, with a focus on increasing the production of cabbage, cauliflower, eggplant, potato, tomato and watermelon. First introduced by IFDC in Bangladesh in the mid-1980s, FDP is the placement of fertilizer briquettes deep into the soil, where the nutrients are utilized more effectively, leading to lower overall use of fertilizer, higher yields and profits and decreased costs for farmers. The project is also developing a private sector, women-led fertilizer supply chain to ensure that women have access to affordable FDP briquettes. In addition, entrepreneurial women are being given the opportunity to purchase fertilizer briquetting machines at a subsidized cost and are trained in the production of the briquettes.

By the end of December 2013, women farmers had planted vegetables on 6,330 ha using FDP technology, nearly doubling the project's original target for FDP coverage. In addition, more than 14,000 women were trained during the 2013/2014 vegetable season. Each training participant received 10 kg of FDP briquettes. In addition, the AAPI-Walmart activity also assisted women farmers in the establishment and management of 39 FDP vegetable demonstration plots. Plans are underway for similar activities for the upcoming summer vegetable season.

Access to key nutrients is one of the most important elements in a child's first 1,000 days. AAPI's partnership with the Walmart Foundation is increasing food and nutrition security for Bangladeshi women and their children by empowering the rural female workforce to diversify their diets. By empowering women with the tools and training to provide their families not only better nutrition but also increased incomes from the sale of surplus fruits and vegetables, IFDC and its partners are better positioning Bangladeshi families for longer, healthier and more prosperous lives.



- ◀ *Opposite: Two children enjoy time at the local market as the adults sell vegetables in Dhaka, Bangladesh. Photo courtesy of Wonderlane/Flickr.*
- ◀ *Left: woman feeds her baby a nutritious meal of small fish, vegetables and rice in Rangpur, Bangladesh. Photo courtesy of Holly Holmes/WorldFish.*



◀ DSSAT enables IFDC project staff, local researchers and extension agents to make site-specific fertilizer and crop recommendations for smallholder farmers. ▶

# IFDC Trains Partners on DSSAT Model for Fertilizer Recommendations

**I**n December, 24 soil scientists and researchers drawn from USAID West Africa Fertilizer Program (USAID WAFP) partner institutions in Ghana, Mali, Liberia and Senegal received training on the use of the Decision Support System for Agro-Technology Transfer (DSSAT) computer model for making site-specific fertilizer recommendations. The regional training, which took place in Saly, Senegal, was organized by IFDC and was a component of activities geared toward achieving USAID WAFP's mandate to increase the efficient use of improved fertilizers in West Africa.

The main objective of the training was to build the capacity of participants (mostly members and potential members of the IFDC-led fertilizer recommendation task forces in WAFP focus countries) in the use of the DSSAT computer application that will assist in the development of more effective fertilizer formulations. The goal is to determine optimal formulations that are adaptable to the specific agro-ecologies in West Africa, eradicating out-of-date and blanket fertilizer

recommendations that make agricultural enterprise in the region risky and unprofitable.

The training also provided a platform for participants who are members of the National Agricultural Research and Extension Systems (NARES) in their respective countries to network and harmonize approaches to developing fertilizer recommendations and generate robust databases for the extrapolation of results within and across countries in the region.

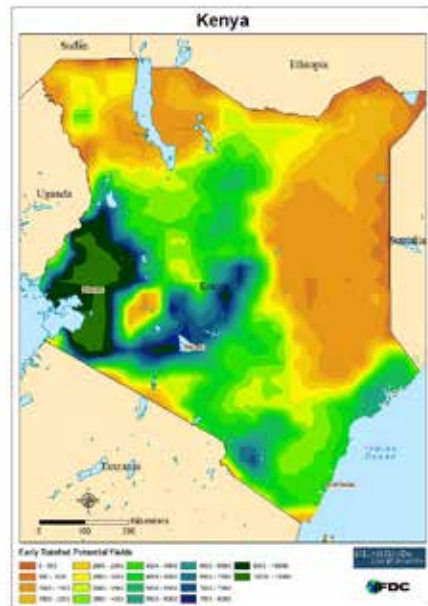
Speaking about the DSSAT modeling application, Dr. Jean Ekwe Dossa, an IFDC soil scientist and coordinator for technology development within USAID WAFP, explained that DSSAT is a tool that simulates crop growth, development and yield as a function of soil-plant-atmosphere dynamics. The model takes into account critical factors including crop physiology, climate, rainfall, soil fertility dynamics and relevant socio-economic factors to extrapolate a meaningful fertilizer formula that addresses prevailing productivity-related issues in each agro-ecology. "The DSSAT is a powerful tool that helps to make decisions in a very short time, as opposed to the traditional manual trials on experimental stations that require so much time to yield results."

# “The DSSAT is a powerful tool that helps to make decisions in a very short time, as opposed to the traditional manual trials on experimental stations that require so much time to yield results.”

– Jean Ekwe Dossa, an IFDC soil scientist and coordinator for technology development within USAID WAFD

Further explaining the usefulness of the modeling tool, IFDC soil scientist and a facilitator at the training, Dr. Jean Sogbedji, indicated that, “the DSSAT model is a means of moving toward precision agriculture, characterized by optimized yields and increased profits versus the experimental type that has been in practice over the years and is riddled with so much risk and uncertainty with little or no profitability to farmers.” He further added that the model is a shortcut to achieving better results and a very effective and powerful tool for addressing site-specific fertilizer formulation issues.

The nine-day training involved basic lessons on integrated soil fertility management (ISFM) and agro-technology processes, precision agriculture and modeling, crop physiology and soil, water, climate and



nutrient dynamics. Participants were taken through the available options of the DSSAT tool for simulating crop production under varying soil, water and climatic conditions to yield different results for comparative analysis and decision-making. Participants also received instruction on how to apply the model in the economic analysis of agricultural enterprises in relation to cost of inputs such as seeds, fertilizers, agrochemicals and technologies against output factors such as yield and profit margins. Several test case exercises were practiced at every stage of the training to enhance understanding.

As a complement to the DSSAT model, participants were also introduced to the Information and Decision Support System (IDSS) model, which works along similar lines of Geographic Information Systems (GIS) technology and facilitates simulations and analysis of factors that affect agricultural production over larger geographical areas. Explaining the importance of the IDSS in an interview, Guillaume Ezui, an agronomist with IFDC and a facilitator of IDSS, indicated that, “the IDSS will help the participants to apply the results and recommendations obtained from DSSAT simulations to an entire country or region. This is critical for making site-specific fertilizer recommendations.”

The training concluded with participants working in groups on specific case studies using the DSSAT tool. The groups worked on cases such as determining N response on soils with low N status under rain-fed conditions, soils with low crop residue addition, soils with high N status and N response in the case of an irrigated maize production system. Groups that were

judged to have excelled in their work and presentation received awards; all participants received certificates of participation.

Participants were generally impressed with the knowledge and skills acquired with respect to the DSSAT model and indicated their readiness and enthusiasm to apply them in their work as scientists and researchers. According to one participant, Dr. Amos Quaye of the University of Ghana Agricultural Research Station, “this training will enable me to make recommendations to farmers as to the right type and quantity of fertilizer to use under given conditions so as to maximize yields and profits, and at the same time prevent excessive leaching and attendant environmental pollution.”

The leader of plant research at l’Institut Sénégalais de la Recherches Agricole (ISRA, Senegal), Dr. Yacine Badiane Ndour, indicated that her institute will use the DSSAT model for a new project, starting in early 2014, to validate the existing fertilizer recommendations and address deficiencies in specific agro-ecologies in Senegal. “Beyond this training, we hope to continue to receive technical support from our trainers and also exchange ideas with NARES members in other countries on the use of the model so that its full benefits can be reaped.”



- ◀ Opposite: GIS maps enable analysis and presentation of crop model results.
- ▶ Dr. Jean Sogbedji, IFDC soil scientist, demonstrates to participants the workings of DSSAT.
- ▶ Participants in the DSSAT training included representatives from various NARES institutions.



## Participating NARES institutions represented at the DSSAT training:

- Institut Senegalais de Recherches Agricoles (ISRA)
- Soil Research Institute (SRI, Ghana)
- Savanna Agricultural Research Institute (SARI)
- Central Agricultural Research Institute (CARI, Liberia)
- Institute of Rural Economics (IER, Mali)
- Institut National de Pédologie (INP)
- Université Gaston Berger – Saint Louis (UGB)
- Centre d’Etude Régional pour l’Amélioration de l’Adaptation à la Sécheresse (CERAAS)
- Laboratoire National de Recherches sur les Productions Végétales (LNRPV)
- University of Ghana Research Station (UG-Legon)

# Unconventional Maize Sheller Boosts Efficiency by 40 Percent



In addition, the hard, dry maize is painful to shell, and the tedious process sometimes leaves hands sore, bruised and bleeding.

The new maize sheller – mounted on the back of a bicycle – removes grains from the husks 40 times

faster than shelling by hand. In 40 minutes, a farmer can fill a 90-kilogram (kg) sack, processing 10-15 bags a day. The sheller also has multiple phone-charging cells attached. Pedaling the bike powers the sheller and charges up to four mobile phones at the same time. The machine requires two people for operation: one to pedal the bicycle and one to insert cobs of maize into the sheller. The bicycle attachments can be easily installed, removed and reattached to common models of bicycles without altering the functionality of the bike.

IFDC recently demonstrated the maize sheller to seed companies and farm groups in Nyankpala. “The technology is not only useful to farmers but

*Most of the world’s 2.5 billion smallholder farmers continue to use primitive farming techniques and labor-intensive post-harvest processes. But access to improved technologies that can save agricultural labor and reduce drudgery is limited. These innovations are often too expensive or cumbersome for integration into rural farming systems across the developing world. Greatly exacerbating the situation, as reported by IFAD, these smallholder farmers are charged with producing more than 80 percent of the food consumed in their regions. Therefore, strategic investments in affordable tools that make their efforts less arduous and more profitable are critical to food security.*

In an effort to provide farmers with these affordable and appropriate technology solutions, the Feed the Future USAID Agriculture Technology Transfer (FTF USAID ATT) project, implemented by IFDC, is introducing a new labor- and time-saving maize sheller in the Northern Region of Ghana in West Africa. Following harvesting, most maize farmers in Ghana shell their output by hand. With workers only able to hand-shell a few kilograms of maize each hour, this practice often takes weeks and requires these farming families to remove their children from school to provide extra labor.

## Fast Facts About Maize

- Over 160 million ha of maize are planted worldwide.
- Worldwide production is more than 800 mmt.
- There are over 3,500 different uses for maize products.
- Maize is Ghana’s primary staple crop.
- Ghanaian farmers produced nearly 2 mmt of maize in 2012.

Source: FAOSTAT and Integrated Breeding Platform



also provides employment opportunities for rural youth,” says Musa Salifu Taylor, FTF USAID ATT organization development advisor. “This gives young entrepreneurs the chance to start a mobile business, biking to nearby communities and shelling farmers’ maize for a fee.”

FTF USAID ATT is also introducing a handheld tool that allows rice farmers to test the moisture content of their seeds. The project has provided maize shellers and seed moisture testers to the Savannah Seed Company and the Shekina Center, which are expected to carry out further demonstrations for remote communities in the region.

The sheller kit was developed by Global Cycle Solutions, a company that develops affordable technology solutions to improve life in rural villages.

▲ Highlighted is Ghana’s Northern Region, which encompasses 70,384 km<sup>2</sup> and a population of about 2.5 million.

◀ Opposite top left: The bicycle maize sheller is demonstrated to farm groups in Nyankpala, Ghana.

◀ Opposite top right: A close-up view of the maize sheller attachment. Photo courtesy of Global Cycle Solutions.

## By the Numbers: Mainstreaming Pro-Poor Fertilizer Access and Innovative Practices in West Africa

The IFDC project (2010-2013) improved the livelihoods of resource-poor smallholders in Benin, Burkina Faso, Ghana and Togo by introducing them to ISFM and fertilizer recommendations for specific cropping systems and agro-ecologies. The project focused on improving depleted soils and best land husbandry practices, while increasing access to and the more efficient use of fertilizer. The project also focused on natural resource management, market and capacity building, private enterprise development and policy advocacy. The project was funded by IFAD.

- Primary cropping systems researched: **beans, cassava, maize, peanuts, rice, sorghum and vegetables**
- Pilot project zones established for implementation and training: **nine**
- Memorandums of Understanding (MoUs) signed for the project: **29**
- Institutions actively involved in project implementation: **22**
- Farmers trained in Participatory Learning and Action Research and ISFM: **11,305**
- Farmers receiving financial credit for fertilizer (a U.S. \$350,000 value): **4,304**
- Stakeholders participating in workshops, symposiums, field days/visits: **8,000**

# Enabling Policies Increase Efficiencies in West African Markets



▲ MIR+ took advantage of agricultural fairs and other events to spread word of the project.

*The increase in agricultural production and subsequent economic growth in West Africa depends on many factors – most notably the existence of demand and supply systems that ensure smallholders’ access to quality agro-inputs at affordable prices. This was the fundamental premise of IFDC’s Marketing Inputs Regionally Plus (MIR+) project and its predecessor, MIR (2003-2008). Completed in December, the project’s mission was to facilitate the development of a regional agro-input market in West Africa and support the implementation of common regional agricultural policies. The MIR+ project was a joint effort by the Economic Community of West African States (ECOWAS) – a coalition of 15 countries – and the West African Economic and Monetary Union (UEMOA). Both regional economic communities (RECs) share an ongoing mission to create a common market based on the free movement of persons, goods and services and the establishment of common tariffs and trade policies.*

To assist in REC efforts to increase agricultural production and economic growth, IFDC provided technical support and policy consultation from 2009

through 2013, which culminated in the enactment of the *ECOWAS Fertilizer Regulation C/REG.13/12/12*. The regulation paves the way for favorable policies and regulated quality standards that will improve the supply and use of fertilizers in the region. As a result of IFDC’s advocacy and consultation, the Center has been requested to lead the coordination of the West Africa Committee for Fertilizer Control, which was formed to support the implementation of *C/REG.13/12/12* across all 15 ECOWAS member states.

IFDC also assisted the region to move toward the implementation of regional seed and pesticide regulatory frameworks with the adoption of two key Implementing Regulations, and developed more than 60 protocols for pest control in the Sahel. In addition, MIR+ conducted pesticide and fertilizer quality assessments, which sensitize stakeholders on the types of quality-related issues and constitute the baseline data required to measure the impact of regional product quality frameworks.

### Beyond Regulations, Modern Technologies Are Key

FDP technology was successfully introduced in 25 sites in four pilot countries (Burkina Faso, Mali, Niger and Senegal) during the life of the project, with promising results on irrigated rice that generated strong momentum for scaling up the FDP technology. To further promote appropriate technologies for the region, a draft regional action plan for updating crop-specific fertilizer recommendations was developed for ECOWAS.

Efforts were also made to improve the availability of and access to technical and marketing information on agro-inputs. In this regard, a regional consensus on the collection of agro-input price variables was achieved, and an approach for building the data collection network was successfully established. Enumerators from nine countries were equipped with digital devices to collect and disseminate data on agro-input prices through monthly reports and a quarterly newsletter. The launch of the new RESIMAO platform ([www.resimao.net](http://www.resimao.net)) in July 2013 now allows for the establishment of a web and mobile-based regional market information system (MIS), adding to the capacity of national MIS administrators.

### Professionalizing Smallholder Farmers

IFDC and partners contributed to improving producer organizations’ (PO) access to agro-inputs in Burkina Faso, Ghana and Nigeria. The capacities of over 1.9 million farmers (34 percent women) were strengthened through training in fertilizer product knowledge and the safe use and handling of pesticides. Through training in demand ‘pooling’ and procurement, the project successfully proved a model for grouped procurement of agro-inputs by small-scale farmers. As a result of these efforts, 131,940 farmers (29 percent women) were linked with 712 agro-dealers and 136 suppliers through 273 local agro-input fairs and 84,275 field days (involving 836 technology demonstrations).

### Sustaining Harmonization

There are positive signs that the momentum generated by the project has been taken up by the RECs and other partners operating in the region since the project end. The ECOWAS Commission is showing commitment to continue to implement the policy framework through its newly established Regional Committee. ECOWAS has requested three regional institutions to complete the harmonization process by facilitating the establishment of three regional committees for policy framework implementation: CILSS for pesticides, IFDC for fertilizers and WECARD for seeds. ECOWAS has



expressed its commitment to support the rollout of FDP across West Africa as part of its regional rice initiative. The ECOWAS Commission also committed U.S. \$500,000 to support further development of RESIMAO through 2017. At the national level, using the market-friendly fertilizer voucher system in Nigeria as a model, Togo is currently preparing a voucher program to be funded by the World Bank. Various master trainers, partner organizations and other development stakeholders will continue to improve the capacity of POs to access agro-inputs in various parts of West Africa.

*IFDC’s MIR+ project was made possible through financial support from the Netherlands’ Directorate-General for International Cooperation (DGIS), while most of the operational costs were borne by the RECs with an additional contribution from DGIS.*

▲ IFDC President and CEO Dr. Amit Roy and Dr. Mohammed Ibn Chambas, then president of the ECOWAS Commission, exchange signed MOUs to facilitate collaboration between IFDC and ECOWAS.

◀ A farmer in Kano State, Nigeria, gives his thumbprint in order to receive his supply of subsidized fertilizer. The Nigeria voucher program has greatly increased farmer access to fertilizer and is the model for an upcoming World Bank-funded voucher program in Togo.

Members of the women farmers association LOFEPACO in the DRC perform songs and skits about ISFM techniques as a way to transfer knowledge.

## IFDC Solutions: Integrated Soil Fertility Management

*Africa's soils, like so many of its people, are hungry. Soil nutrient depletion and population increases have caused per capita food production to decrease over the past 30 years in SSA. African farmers have traditionally cleared land, grown crops for a few seasons and then moved on to clear more land. This practice left the abandoned soils fallow, allowing them to regain fertility over time. But constant population growth now forces farmers to continually plant crops on the same land, 'mining' the soil of its nutrients.*

Clearly a long-term environmental issue, it is also an economic issue: soils depleted of their nutrients cannot properly feed a crop. The result is lower yields, reduced incomes and the poverty and malnutrition that follow for the continent's smallholder farming families.

But solutions are available. Since the early 1990s, IFDC has promoted a site-, soil- and crop-specific approach to combating low soil fertility. ISFM helps smallholders increase agricultural productivity while protecting the environment and enhancing the soil resource base.

ISFM strategies center on the combined use of mineral fertilizers and locally available organic amendments (crop residues, compost and green manure) to replenish lost nutrients. This improves both soil quality and the efficiency of fertilizers and other agro-inputs. ISFM also promotes improved crop management practices, measures to control erosion and techniques to improve soil organic matter – all efforts that improve crop production and increase farmer incomes. In fact, smallholder farmers who have adopted ISFM have more than doubled agricultural productivity and increased their incomes by 20 to 50 percent.

In East Africa, ISFM has been key to several projects, including the Catalyze Accelerated Agricultural Intensification for Social and Environmental Stability (CATALIST), CATALIST-2 and CATALIST-Uganda projects. During CATALIST, 250,000 farming families increased their crop production and incomes through an integrated approach that combined a number of sustainable agricultural intensification technologies, with a particular focus on ISFM. CATALIST-2 (in Burundi, the Democratic Republic of the Congo [DRC] and Rwanda) and CATALIST-Uganda are building upon successful ISFM efforts within CATALIST. The projects are improving soil quality and crop productivity, and are also building market linkages so that as farming families do increase their yields, they have equitable markets and eager buyers for their outputs. These projects will continue through 2016.

To learn more about IFDC's expertise in ISFM, visit [www.ifdc.org/Technologies/ISFM/](http://www.ifdc.org/Technologies/ISFM/). Also, be sure to browse through IFDC's historical timeline (1989 onward) to learn more about how and when IFDC developed its ISFM solutions.

# PROFIT+ Encourages Lead Farmers to “Pass it On”



▲ A demonstration host farmer displays her soybean crop.

▶ Opposite: A project staff member and a lead farmer discuss management techniques at a demonstration field.

*As Zambia moves toward a more diversified economy that depends less on the often-volatile copper industry, the government of the Republic of Zambia is pursuing an economic diversification program with a major emphasis on agriculture. Like many other countries working to stabilize and professionalize their economies, Zambia has the natural potential to overcome its mining dependency with the cultivation of an assortment of agricultural products such as cassava, coffee, cotton, maize, peanuts, rice, sorghum, sunflower seeds, tobacco, vegetables and livestock.*

Realizing Zambia's array of potential entry points into professional markets, USAID created a development project that targets smallholder farmers and agro-enterprises. The effort is being implemented by ACDI/VOCA. The purpose of the project is to increase agricultural productivity and facilitate inclusive access to markets and private sector investment in targeted value chains. IFDC's role in the USAID-funded Production, Finance and Improved Technology Plus (PROFIT+) project is to improve the productivity of selected commodities and develop commercial agro-input markets. Other collaborating partners include Associates for International Resources and Development, Catholic Relief Services, Crown Agents USA, Danya International and Kimetrica.

PROFIT+, which began in 2012, empowers smallholder farmers in a value chain approach. The project is bolstering the agriculture sector as a means for Zambia

to achieve a robust and stable economy, with agriculture becoming a more substantial portion of the nation's GDP. A core activity of the USAID FTF initiative, PROFIT+ is improving smallholder productivity and creating greater access to markets and trade for 200,000 smallholder producers and processors, and is driving U.S. \$50 million in increased private sector investment in agriculture-related activities.

Throughout the project, IFDC is working to improve smallholder productivity through improved agricultural practices such as ISFM while creating a strong inputs supply chain. As an expert in capacity building and training, IFDC also employs a cadre of demonstration host farmers (DHF) and Farmer Business Advisors (FBAs) who establish demonstration plots to display the benefits of ISFM and other improved agricultural technologies.

In the past year, IFDC's efforts have resulted in yield increases of 67 percent for over 70 DHFs managing over 280 demonstration plots. While on the surface these numbers may appear small, the DHF model exponentially increases the number of farmers who learn about and adopt the skills and technologies displayed at the demonstration farms. In the last year alone, DHFs transferred their expertise to 3,349 smallholder farmers during 20 farmer field days. By the end of the upcoming season, 690 DHFs (37 percent of whom are women) will have established even more demonstration plots to train thousands more smallholder farmers, increasing yields and incomes for all involved. In addition, 60 FBAs have been selected to host hundreds of demonstration plots for tomato and onion seedlings, and 100 other business owners have been trained in horticulture seedling production. This knowledge will then be disseminated to over 8,100 smallholder farmers.

Not to overlook the remainder of the value chain, IFDC has trained 123 agro-dealers in business skills and product knowledge, many of whom have created or joined agro-dealer associations officially incorporated by Zambia's Patents and Companies Registration Agency (PACRA). These agro-dealers now have increased access to certified seed. IFDC has also sponsored staff from

the Eastern Province Farmers Cooperative (EPFC) to be trained as certified seed inspectors. By collaborating with Zambia's Ministry of Agriculture and Livestock staff, IFDC has prepared extension agents to support the growing number of professionalized agro-dealers.

Through 2016, PROFIT+ staff is projecting to achieve a 30 percent increase in productivity and income from selected value chains, benefit 200,000 smallholder farmers and increase the value of agricultural sales by \$125 million, particularly for value-added processing.

As recently demonstrated by state officials in Nigeria and several other Sub-Saharan nations, singular dependency on the oil or mining industries is no longer a sustainable



economic solution. Showing much less historical market volatility, agriculture as a primary contributor to GDP can move entire nations from net importers of food to net exporters, and from developing-nation status to that of an emerging market ripe for further external investment. PROFIT+ is poised to be an economic catalyst for Zambia, as IFDC continues to build value chains and train participants to pass along their knowledge and experience for a stronger agriculture sector.

# PReFER Project Improves Fertilizer Supply in Rwanda



▲ An agro-dealer discusses business in his shop in Rutsiro, Rwanda.

*Representing one-third of Rwanda's GDP and employing 80 percent of its workforce, Rwanda's agriculture sector has a powerful impact on the country's overall economy. The country is one of the most densely populated in SSA, and only about 60 percent of its mountainous landscape is cultivated. With limited arable land and a rapidly growing population, food security remains a major challenge.*

Rwanda's success in bringing 1 million more citizens out of poverty over the past five years has been well-documented, and its commitment to agriculture as a major driver of the nation's economy has led to its rise on a short list of nations in SSA to achieve the Millennium Development Goals (MDGs), specifically MDG 1. However, according to a 2013 fertilizer assessment by IFDC and the African Fertilizer and Agribusiness Partnership (AFAP), Rwanda must gradually increase current fertilizer use and consumption nearly seven-fold by 2017 in order to achieve its agriculture development targets outlined in the nation's Strategic Plan for Agriculture Transformation III (SPAT III). As the study notes, for this target to be met, the private sector must not only thrive in partnership and with support from the Rwandan government but it must lead the way in the evolution toward a free market agricultural system.

## Changing Farmers' Perceptions Is Key

In 2007, Rwanda's Ministry of Agriculture and Animal Resources (MINAGRI) launched the Crop Intensification Program (CIP), which included a fertilizer subsidy program that significantly increased

fertilizer demand and use in the country. Fertilizer consumption rose from roughly 8,000 mt in 2007 to about 35,000 mt in 2012. But true market development progress is measured in very specific terms, most notably in its sustainability. Perhaps as an unintended consequence, the government-controlled subsidy program, among other factors, created an "artificial" market that lacked long-term viability. With complete control of fertilizer purchasing and distribution, the private sector lacked incentive to build investment in Rwanda's agricultural system. Further complicating matters was the fact that government demand for farmer payment of the unsubsidized fertilizer portion, provided on credit, waned over time. Eventually, farmers were left with the hard-held impression that fertilizer was, and should be, free to them.

In a committed attempt to rectify these issues, the Rwandan government announced in March 2013 that it would transfer responsibility for fertilizer supply to the private sector with support from IFDC's Privatization of Rwanda's Fertilizer Import and Distribution System (PReFER) project. With funding from USAID, PReFER staff are working with MINAGRI to identify policies supportive of private sector enterprise in the fertilizer market, while contributing to the development of a sustainable procurement and distribution system.

## Professionalizing Private Sector Suppliers

In 2012, IFDC/PReFER began working with the fertilizer distributor ENAS to improve efficiencies in the company's supply chain. The activity covers six districts, 86 agro-dealers and 81,418 farmers in Rwanda's Eastern Province. In the 2012-A season, ENAS delivered

more than 18 percent of Rwanda's annual fertilizer consumption, achieving sales of \$5.2 million. Most of the fertilizer was distributed on credit and a quarter of farmers purchased the input using a subsidy voucher.

Importantly, ENAS teams are being trained to collect payments for fertilizer purchased on credit through the voucher system. Outstanding loans total approximately \$2.56 million. To increase the loan repayment rate, the PReFER team organized meetings with distributors, agro-dealers, service providers, local authorities, agronomists and farmers emphasizing that fertilizer was not a free gift from the government. With PReFER's assistance, the loan collection rate more than doubled from only 15 percent in 2012 to 36 percent in 2013. Though the rate may still appear to be low, farmer views are changing, and project leaders believe more progress will come in the future.

## New Technology Will Improve Supply

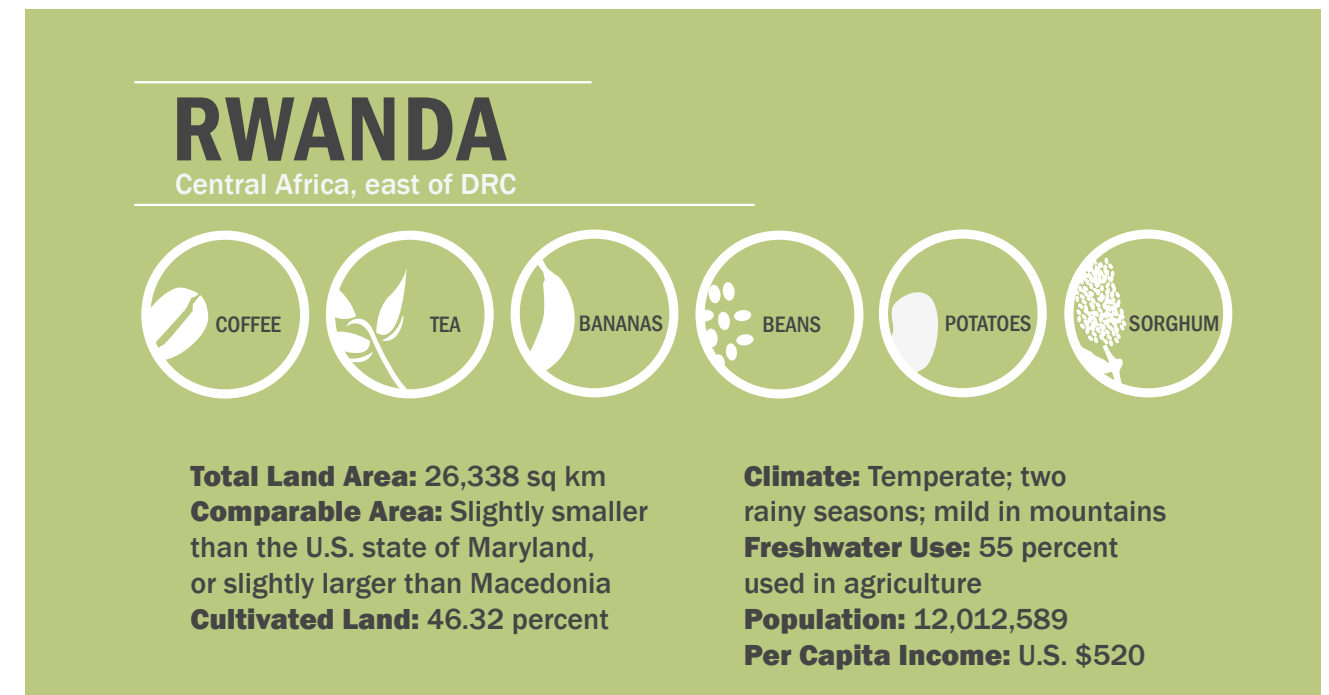
To further improve operational efficiencies and facilitate effective communication along the supply chain, PReFER is introducing mFarms, an information technology (IT) platform that uses mobile phone and web applications to help stakeholders establish and maintain business relationships and manage the flow and volume of goods and services.

Importers, warehouse managers, distributors and agro-dealers use mFarms to monitor day-to-day transactions. Real-time data is stored in geo-referenced databases,

saving time and financial resources for stakeholders. For example, distributors and importers who use mFarms no longer must visit agro-dealers to check sales and inventories. This allows stakeholders the opportunity to offer new value-added services such as market analysis, demand forecasting and better disaggregation of statistics on consumption.

PReFer is currently training 49 agro-dealers and 15 fertilizer warehouse managers on mFarms, which is slated to become available to the entire country in 2014, benefiting as many as 416 agro-dealers. PReFER plans to equip those involved in the supply chain with smart phones pre-loaded with the mFarms mobile application in both English and Kinyarwanda.

Accessibility to more disaggregated data, along with other moves toward privatization, will allow fertilizer importers to effectively plan the supply, distribution and proper pricing of the appropriate quality and quantity of fertilizers required for maximum crop yields. And such advances are leading to greater profitability for smallholder farmers, agro-dealers and private sector importers alike, and ultimately the nation's GDP, which will allow Rwanda to bring still more millions of its citizens out of poverty. This is, as IFDC experts note, the power of privatization.



# 2SCALE: A Diverse Approach to Agribusiness in Africa



▲ Farmers at a chili pepper cluster in Kenya share their knowledge at a farmer field day.

*Funded by the Kingdom of the Netherlands and partnered by a number of private sector enterprises, the 2SCALE project is changing Sub-Saharan Africa's agricultural business landscape with the creation of hundreds of agribusiness partnerships among farmer groups and private businesses. Hundreds of thousands of farmers in nearly a dozen countries now have access to improved farming technologies, business support services and profitable markets, where they are engaging in trade with reliable buyers at equitable market prices.*

In less than two years, 196 agribusiness clusters (ABCs), or groups of professionalized farmers cultivating the same food or cash crop, have been established in 11 of the 12 countries targeted by the project. A total of 390,000 farmers – 38 percent of whom are women – are now linked to more than 1,900 private firms and are using improved technologies to produce commodities for their specialized markets. Each ABC is backed by a support network that provides training, year-round advice on technical and financial issues and assistance in entering new markets.

## Diversity with a Purpose

2SCALE ABCs produce 36 different commodities, a diversity resulting from the project's unique approach. Every intervention begins with a business proposal, usually submitted by entrepreneurs within a given community. Their business creativity within these rural settings regarding the most potentially profitable crop production and related activities – and their willingness to think out of the box to find viable business solutions – is reflected in the diversity and quality of the proposals.

The project portfolio focuses on several core commodities, identified through detailed analyses of soils, climatic conditions, market trends and other factors. In each country, IFDC is building a critical mass of ABCs around priority commodities without excluding unconventional business opportunities. Food staples such as rice and maize, cash crops such as potatoes and soybeans, and horticulture are important in many countries. Other crops and food products are targeted at specific agro-ecologies levels or market niches. For example, priority crops in Benin are pineapple, maize, soybeans and vegetables, while in Mali the priorities are rice, maize, sesame and vegetables. Although most clusters focus on a single commodity, vegetable clusters often produce a range of vegetable crops for their targeted purchasing partners.



▲ ABC members, such as these maize farmers in Togo, are the driving force of 2SCALE.

2SCALE is addressing a whole new set of challenges – logistics, trade regulations and market infrastructure – in addition to the basic challenge of transitioning from subsistence to market-oriented agriculture, or 'agriculture as a business.' To date, the project has seen success because of this business-driven approach. The lead implementing partners – IFDC, Base of the Pyramid Innovation Center (BoP Inc) and the International Centre for development oriented Research in Agriculture (ICRA) – each complement the other's strengths, forming a coalition that is leading this agricultural transformation.

## Action Research

The project supports 'action research' to introduce, test, modify and promote innovations. Midway through the project's second season, 64 ABCs in 10 countries have adopted innovations to improve productivity, quality and profitability. These include new technologies (soil fertility management methods, new crops or varieties, processing methods, drip irrigation, etc.) as well as institutional innovations for aggregating produce, tracking product flows or reducing transport costs. For example, action research in Oyo State, Nigeria, has catalyzed the adoption of new dairy technologies such as feed supplementation, vaccinations and artificial insemination. Cows that once produced less than 2.0 liters of milk per day now produce 3.5 liters. Profitability per lactating animal has increased by nearly 80 percent. And farmers are investing time and money in these

technologies to further increase profits. In Kenya, over 2,000 farmers in Tharaka County are part of an innovative 'franchising' model for distributing seeds, fertilizers and other farm inputs to remote communities. In this case, 2SCALE teams help provide training, develop the distribution chain, connect farmers with micro-finance providers, link sorghum and pigeon pea farmers to reliable markets and even introduce new high-profit crops such as chili peppers.

## Private Investment: The Impact Multiplier

The 2SCALE approach is anchored within the community, but is based on measurable economic criteria. Perhaps the best proof of the effectiveness of this approach is the level of private investment that has been developed. Each ABC operates based on a cluster Action Plan developed jointly by the business champion,<sup>1</sup> the farmers and other cluster participants. The bulk of the resources for the implementation of these plans comes not from the project but from the cluster participants themselves, who contribute cash or time. Half of the project budget is financed by the private sector – large and small firms trading with 2SCALE ABCs – confident that they will receive high returns on their investments.

*The 2SCALE project will run through 2017, and is funded 50 percent by the Netherlands' DGIS and 50 percent through investment from private sector enterprises.*

## Commodities Promoted Through 2SCALE

Aromatic plants	Palm oil
Bananas	Paprika
Cabbage	Pepper
Cashew	Pineapple
Cassava	Groundnuts
Cheese	Potatoes
Chilies	Sweet Potatoes
Beef	Poultry
Cowpea	Rabbits
Fish	Rice, Parboiled Rice
Forages	Sesame
Ginger	Shea Butter
Guinea fowl	Sorghum
Maize	Soybeans
Mango	Stevia
Milk	Tomato
Millet	Yam
Onions	

<sup>1</sup> The business champion is the originator of the business proposal. Business champions are mostly processors (e.g., a potato chip manufacturer who buys in bulk) or farmer cooperatives, but also include a variety of other businesses, such as micro-finance companies.

# Quantifying GHG Emissions in Rice: Comparing Old and New Technologies



▲ BRRI researchers transplant rice at a greenhouse gas emissions station in Gazipur, Bangladesh.

*The production of rice – which accounts for more than one-fifth of all calories consumed by humans – is forecast to reach a record 471.5 million tons in 2013/14, according to estimates by the U.S. Department of Agriculture. Keeping rice production high is critical to global food security, particularly in developing nations such as Bangladesh where the cereal is the population's primary staple food – making up more than two-thirds of citizens' diets. The crop is also vital to the livelihoods of the millions of smallholder farmers who grow it.*

According to the International Rice Research Institute (IRRI), rice production must grow parallel to the rate of population growth. Rice farming, however, is one of the world's major sources of greenhouse gas (GHG) emissions, particularly methane, nitrous oxide (N<sub>2</sub>O) and nitric oxide (NO). N<sub>2</sub>O is a potent greenhouse gas – 1 kg of N<sub>2</sub>O is equivalent to 298 kg of carbon dioxide (CO<sub>2</sub>). In other words, over a 100-year period, N<sub>2</sub>O traps nearly 300 times more heat than CO<sub>2</sub>. Currently the third largest contributor to global warming after carbon dioxide and methane, N<sub>2</sub>O is also responsible for depletion of the stratospheric ozone layer, which increases solar ultraviolet radiation. NO is also an air pollutant responsible for global warming and the formation of acid rain.

Ironically, while rice production contributes greatly to GHG emissions, under current practices these emissions create conditions that are intolerable for the future level of rice growth needed to feed an ever-growing population. According to IRRI, rice production decreases by 5 percent for every 1 degree Celsius (C) increase in temperature over 32 degrees C.

## Finding Answers to Rice GHGs in Bangladesh

In Bangladesh, rice paddies account for about 80 percent of land devoted to agriculture, which makes the South Asian country a prime candidate for GHG research. In 2013, IFDC began conducting research to quantify N losses (as N<sub>2</sub>O and NO) specifically in rice production – the first time such measurements have been taken in the nation. Experts agree that quantifying such emissions is critical to determining appropriate mitigation strategies.

Emissions of the pollutants are determined by measuring the levels of soil moisture content and N fertilization in rice cropping systems. The data are collected through an IFDC-developed advanced automated gas sampling system that takes continuous long-term measurements of the amount of NO and N<sub>2</sub>O released from the soil during rice production, and also during the non-rice/fallow period. In the summer of 2013, IFDC's AAPI project, with funding from USAID, installed greenhouse gas chambers on paddy fields at the Bangladesh Rice Research Institute (BRRI) and Bangladesh Agricultural University (BAU), strengthening these partner research organizations' capacities to understand climate change issues related to the crop.

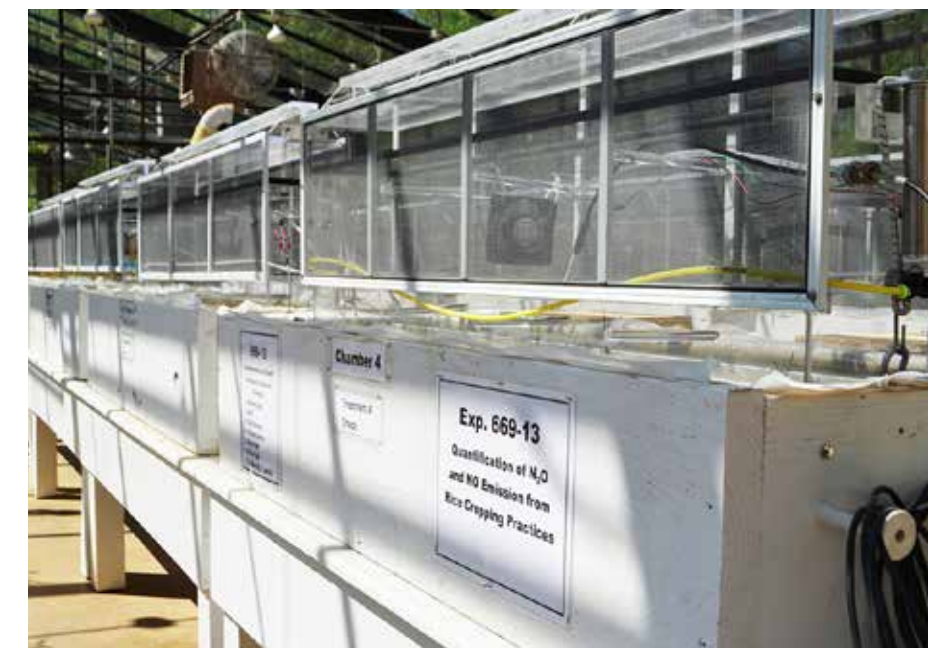
## Can More Efficient Fertilizers Mitigate Emissions?

The answer is: very possibly, but more research is required. The project is currently quantifying the environmental benefits of FDP technology and introducing water-saving irrigation technology such as alternate wetting and drying (AWD). FDP, the deep placement of fertilizer briquettes into the rice root zone, is a more efficient method of fertilization than farmers' traditional practice of broadcasting and results in less N volatilization and higher crop uptake of the nutrient. The project's latest results suggest that more N is lost in floodwater when prilled or granular urea is broadcast versus deep placement of urea and NPK briquettes. Because of their deep point

placement, the briquettes do not come in direct contact with the floodwater or atmosphere.

Rice is generally grown under continuously flooded conditions, requiring nearly 3,000 liters of water to produce 1 kg of rice. According to AAPI research, changing the water regime from continuously flooded to AWD – a unique irrigation system in which the paddy field is alternately flooded and then not flooded – could alter the carbon and N dynamics of the soil. The ultimate goal of GHG-AWD research is to accrue the benefits of AWD while minimizing GHG emissions.

The project will continue to collect data from test plots at BRRI in Gazipur and BAU in Mymensingh until late 2014, where IFDC-trained scientists maintain the gas sampling systems and analyzers and calculate emissions rates. The activity integrates two U.S. government programs – the Feed the Future initiative and the Global Climate Change Initiative. In addition, the program addresses objectives set forth by the Bangladesh government in its Bangladesh Country Development Cooperation Strategy, 2001-2016.



▲ GHG measurement chambers constructed at IFDC headquarters in Muscle Shoals, Alabama.

# IFDC Technology Leads Rice Sector Revolution in Africa



- ▲ IFDC staff conducts FDP trainings for farmers interested in adopting the technology in their rice production.
- ▶ Opposite: IFDC is assisting fertilizer companies, such as Notore, to manufacture and introduce fertilizer briquettes into the market.

*Rice, the fastest-growing cereal crop in Africa, has been grown by West African farmers along the Niger River for thousands of years. West Africans have historically depended on the plant during lean harvest years, and it is now a staple food for those who can afford it. Although domestic rice production is increasing at an annual rate of 6 percent, it has not kept pace with rapidly increasing demand. Compared with South Asia, the world's largest producer of paddy rice at over 229 mmt annually, the African continent produces a mere 26 mmt.*

Closing this global production gap and more efficiently feeding the continent's growing population is a critical

concern, especially considering that most national and regional fertilizer supply chains offer only granular or prilled urea in rice cultivation. When this form of urea is broadcast into flooded paddy fields, two-thirds of the fertilizer is lost to the environment as run-off or gaseous emissions, costing the farmer dearly in the form of lower crop yields and higher production expenses.

With a history of agricultural development intervention in Africa that stretches back to 1976, and a foundation in fertilizer development and diffusion that has transformed entire nations, IFDC continues to be well-positioned to address such production concerns. As early as 2008, IFDC began seeking solutions to SSA's rice production issues by introducing FDP.

IFDC first introduced FDP in Bangladesh in the mid-1980s, where the technology continues to increase yields

by 15-18 percent and decrease the amount of fertilizer used by one-third. FDP briquettes (1.8 to 2.7 grams) are placed deep into the soil, near the root of the plant, and release nutrients gradually in a way that coincides with the crop's requirements. In addition, FDP reduces N volatilization in the form of harmful greenhouse gas emissions and mitigates the risk of groundwater or waterway contamination due to its slow nutrient release qualities.

For the past six years, IFDC has gradually increased technology dissemination into select areas of SSA through extensive field trials and adaptive and participatory research conducted within its numerous development projects. Over that period, the Center has conducted West African FDP trials, led by Dr. Bidjokazo Fofana, along the Niger River in Mali, and in Burkina Faso, Liberia, Nigeria and Senegal, with increasingly positive results. The average yield advantage of FDP over urea broadcasting in West Africa is about 20 percent with 15 percent lower production costs and 18 percent higher financial returns. Early indications show that the technology is not only viable in the region but that it can also secure the rice sector as the fastest-growing among cereal crops.

## Building FDP Market Demand

With funding from USAID, ECOWAS and other stakeholders, multiple IFDC projects in the region are training farmers on FDP technology and demonstrating its results side-by-side with farmers' traditional practice



of broadcasting fertilizer, showing the dramatic difference in crop output. "FDP is proving to be a technological option that fits well into small-scale rice farming systems across West Africa because it reduces the amount of fertilizer required while increasing crop productivity in irrigated rice," said Fofana. "Proactive farmers have even started using FDP on various high-value crops such as tomato, onion, sugarcane and maize, without any preliminary field trials or results on its crop-specific performance."

And perhaps that is the most promising aspect of FDP; once smallholder farmers understand the technology, they are eager to experiment. Few other fertilizer technologies inspire such proactive experimentation, especially in SSA, where the adoption of new forms of fertilizer is often rejected due to potential financial risk to the farmer. "We expect that FDP will spread farmer to farmer, in many instances without our intervention," said Fofana. "No farmer wants to see a neighbor's field that is producing nearly 20 percent more than theirs. But proper training in all instances is critical, so we will continue to engage farmers, agro-dealers, extension agents and others to ensure that anyone who wishes to adopt FDP can do so with the proper knowledge of application procedures."

## Facilitating FDP Market Supply

In order for farming communities to utilize FDP effectively, they must have a sustainable supply of fertilizer briquettes, which are produced using briquetting machines that compact prilled or granulated fertilizer into large granules, or briquettes. From the early days of FDP development, IFDC experts saw the manufacture of briquettes as a profitable business opportunity for village-level entrepreneurs, with an unequaled ability to contribute to local economic development. In West Africa, local entrepreneurs and large private sector fertilizer suppliers alike are recognizing the economic potential in these emerging markets for NPK and urea fertilizer briquettes.

To further encourage private sector investment, IFDC is improving expertise in briquetting techniques. Recently, three USAID-funded projects held a five-day training program in Abuja, Nigeria, on the production of commercial fertilizer briquettes. The IFDC projects – USAID WAFP, Maximizing Agricultural Revenue for Key Enterprises in Targeted Sites II (MARKETS II) and FTF USAID ATT – organized the program for private fertilizer companies from Ghana, Liberia and Nigeria.

More than 30 participants were introduced to key factors that influence the briquetting process, such as proper machine operation, maintenance and safety and factors that affect the end quality of the briquettes, such as the quality and quantity of raw materials. IFDC is working with select private sector companies in West Africa to facilitate the production and supply of FDP briquettes to targeted markets. This includes developing distribution channels, facilitating the procurement of briquetting machines and introducing various packaging sizes to ensure that briquettes are affordable to smallholder farmers.



▲ A CATALIST-2 agronomist demonstrates how to use a fertilizer briquette applicator.

▶ Opposite: Farmers view an educational video on FDP.

### FDP: Empowering Farmers to Build Agriculture Sub-Sectors

As most agricultural experts will attest, new technology development and diffusion, particularly in the developing world, can be a daunting and time-consuming task, with no promise that the technology will take hold in a widespread and sustainable manner. FDP, over the past 30 years, seems to have avoided a number of those pitfalls and continues to be a proven technology that is easily adopted and quick to show dramatic results and benefits. As such, FDP will

continue to be introduced into various SSA markets alongside other advanced agricultural technologies. With proper efforts, FDP will enable farmers to leverage these technologies to increase both production and profits, empowering them to begin to contribute to substantial rice production increases and greater food security.

### FDP Technology Extension Grows in East Africa

FDP – an innovative fertilizer application technology that has proven its impact in increasing crop productivity in Asia and West Africa – is now being widely demonstrated in East Africa and will be critical to future extension strategies in the region.

During 2010-2011, IFDC's CATALIST project established initial FDP trials in Burundi, DRC and Rwanda. Results were encouraging; the field-tested technology measurably increased crop yields, used less fertilizer and decreased environmental damage.

Mukankusi Berthe, a rice farmer in the Bugarama marshland of Rwanda, was part of a group of farmers that tested the new technology. "Following the deep placement of urea briquettes between four rice seedlings, I was surprised to harvest 118 kilograms of paddy rice in my small plot, where I had only 50 kilograms of paddy before," Berthe said.

In partnership with the Rwanda Agriculture Board (RAB), IFDC's CATALIST-2 project is now promoting the use of FDP for rice farming on a large scale. More than 200 demonstration plots have been installed in 10 marshlands across the country for the 2014A planting season. Organized in groups, rice farmers are learning how FDP works during the paddy transplanting period. Farmers receive further training on the various rice development stages through farmer field school sessions.

According to agronomic findings observed so far, it is expected that the harvest from FDP demonstration plots will be far better than comparison plots using traditional practices. Data collected by RAB and IFDC specialists on 14 sites throughout the country show a larger number of tillers in the FDP plots. This indicates a large number of grains at the grain filling stage and, therefore, a good harvest.



### Educating Farmers Through Mobile Cinema

CATALIST-2 recently organized video presentations on FDP in the Southern, Western and Eastern provinces of Rwanda, areas where rice is typically cultivated. 'Mobile cinema' is proving to be a useful communications tool to educate rural farmers on agricultural best practices and facilitate dialogue among project beneficiaries.

The 16-minute video, produced in the local language, explains FDP technology and includes several testimonies from rice farmers in the Bugarama Plains. Each presentation was followed by a discussion session in which farmers shared their concerns and received feedback from IFDC experts. Before watching the film, farmers visited FDP demonstration plots with agronomists to assess various rice development stages. Because farmers in such remote areas do not have access to television, they were very enthusiastic to participate. Ten viewings were held for more than 1,000 project beneficiaries.

*CATALIST-2 is funded by the Netherlands' Ministry of Foreign Affairs through the embassies of the Kingdom of the Netherlands in Burundi, DRC and Rwanda and the Swiss Agency for Development and Cooperation.*

## New Fertilizer Blends in Burundi Feature Urea Briquettes

The Projet d'Accompagnement du Nouveau Programme National de Subvention des Engrais au Burundi (PAN-PNSEB) recently organized a training program on FDP and on data collection tools for new fertilization formula trials. Twenty-two local agronomists from three provinces in Western Burundi (Bujumbura, Bubanza and Cibitoke) attended the program in Cibitoke.

The new fertilizer blends were formulated by IFDC, the Burundi Ministry of Agriculture and Livestock (MINAGRIE) and the National Institute of Agronomic Sciences (ISABU) following an analysis of Burundian soil samples in 2013. The on-farm trials will determine if the new blends are the most suitable for local crops. Until now, fertilizer recommendations in Burundi dated as far back as 1985.

The trials are evaluating the use of urea briquettes for rice. Two types of trials are being conducted: a trial comparing the current formula and a trial of subtraction in which several micronutrients are eliminated in order to determine their influence on the crops.

Similar training sessions were held in Bururi, Gitega and Ngozi. Additional trials will be conducted in 1,680 sites in 107 communes of Burundi, and demonstration plots have been installed in 1,000 sites.

*PAN-PNSEB is funded by the Netherlands' Ministry of Foreign Affairs.*

# VFRC Creates New Scientific Protocols for Developing Novel Fertilizers

*The Virtual Fertilizer Research Center (VFRC)<sup>1</sup> has begun to develop a comprehensive overview of plant and nutrient processes as the basis for the establishment of new scientific protocols for future research. VFRC Executive Director Prem Bindraban argues that by focusing research on basic biological and ecological processes, the Center and its science partners will be better positioned to quickly bring more efficient and effective fertilizer technologies to market, particularly those that are accessible and affordable to smallholder farmers. To that end, the VFRC and its partners have released five VFRC Reports that begin to form a basis for standardization in the Center's research and development efforts.*

"We need to make sure our avenues to arrive at innovative fertilizers are truly scientifically based," says Bindraban, citing that many studies, for example on foliar spray efficacy, basically employ ad hoc, trial and error experimentation, often without understanding the biological mechanisms assumed to carry nutrients from points of application to points of biological metabolism. "We must truly understand how plant biology works," Bindraban notes, "before we can create protocols for effectively developing and testing new nutrient products." According to Bindraban, different plants most likely require different resources – and these may need to be applied in different ways. For instance, improving the yield and nutritional quality of leafy vegetables through foliar fertilizers may be effective. Yet, improving the quality of cereals through the same mechanism may not be effective if nutrients cannot be translocated from the leaves to the grains.

<sup>1</sup>The VFRC is a semi-autonomous unit of IFDC. Operated in a virtual environment, the Center connects scientists and researchers around the world in collaboration on various technological advances related to fertilizer and agricultural production processes. The VFRC is independently funded by various bilateral and multilateral aid agencies and is supported by an international board of advisors representing both developed and developing countries and various business sectors.

It is essential therefore to understand the biochemical pathways of nutrients.

These complexities in nutrient delivery, uptake and metabolism have led the VFRC to five basic considerations (referred to by the Center as the "Fertilizer Tech5") when exploring new fertilizer technology: composition (what combination of nutrients), packaging (in what chemical form or carrier), application (in what way), crop (on what plant) and ecosystem (what ecological and environmental condition).



A good example of the Tech5 concept can be seen in current research on legumes. While most legumes symbiotically use Rhizobium to fix nitrogen, they remain very difficult to grow in many parts of the world without an adequate supply of P (composition), and they also may not grow well in soils lacking sufficient micronutrients such as copper, zinc or molybdenum. Further, in what form will the P or secondary and micronutrients be applied (packaging) – as a liquid or solid? As a blend or singularly? Can we 'bypass' the soil as a nutrient-providing medium through foliar application of some nutrients? Are they being grown in a cycle or intercropped (ecosystem)? How should the nutrient be applied (application)? If legumes are being grown singularly, foliar sprays could be cost-effective for a farmer, whereas if intercropped, a blend may be more effective, depending on the other plant being intercropped (crop). In Bindraban's view, these questions should be evaluated and discussed on the outset of

fundamental research, not as an afterthought. "If we want solutions, we have to think out of the box, but we have to do it in the most thoughtful way possible," says Bindraban. "That means that instead of myopically focusing on the 'lifeless' chemical processes that produced the last big breakthrough in fertilizer technology (that took place over the past 50 to 100 years, mind you), we have to focus on the 'living' biological processes and instruct the chemists how to best 'package' the nutrients. Understanding these basic living and lifeless processes and their interactions will get viable solutions into the pipeline." To wit, researchers know, for example, that microorganisms and fungi can extend root length to exploit soil nutrients, and that plant roots excrete organic acids to pull more P from the soil. But before such knowledge can be exploited, these – along with other biological processes – must be better understood. By providing protocols for research based on the lessons learned from the published reports, the VFRC and its collaborating partners waste no time with trial-and-error but rather focus on truly viable options both in improving current fertilizer technology for today and creating novel fertilizer technologies for tomorrow.

The VFRC Reports underpin the Center's research into the next generation of fertilizer technologies that are in the pipeline for both the short- and medium-term future. "We can and should improve the way we use our current fertilizers – an endeavor that is undertaken by virtually all agronomists and research institutions – which is the solution for the present. On a parallel track, the VFRC is also preparing for the next generation of fertilizers for tomorrow and for five and ten years from today," says Bindraban. The reports can be found at [www.vfrc.org/Research/VFRC\\_Reports](http://www.vfrc.org/Research/VFRC_Reports).



## Global TraPs Book Explores Sustainable Phosphorus Management

The Global Transdisciplinary Processes for Sustainable Phosphorus Management (Global TraPs), a multi-stakeholder initiative led by IFDC and Fraunhofer IWKS, has published a Springer book titled *Sustainable Phosphorus Management: A Global Transdisciplinary Roadmap* that covers the economic scarcity of phosphorus and options to improve efficiency and reduce environmental impacts of anthropogenic phosphorus flows at every stage of production, supply and use.

The Global TraPs initiative involves scientists and key actors from across a variety of disciplines and nodes of the phosphorus supply-demand chain, including the fields of exploration, mining, processing, use, dissipation and recycling, trade and finance.

Project leaders Dr. Amit H. Roy, president and CEO of IFDC, and Dr. Roland W. Scholz of Fraunhofer IWKS (and formerly of ETH Zurich) explain that the book defines pathways to sustainable phosphorus and raises the challenge for innovative fertilizer products and production processes in order to establish a more efficient industry supply chain. Fifty-three authors, including 19 practitioners and 24 scientists from public science institutions (primarily from universities) contributed to the book. For more information, visit: [bit.ly/1f6rHAV](http://bit.ly/1f6rHAV).



# Honoring the Norman Borlaug Centennial

*“The battle to ensure food security for hundreds of millions of miserably poor people is far from won. We must increase world food supplies but also recognize the links between population growth, food production, and environmental sustainability. Without a better balance, efforts to halt global poverty will grind to a halt.” – Norman Borlaug, Science, Vol. 318, October 2007*



March 25, 2014, marks the 100th birthday of Dr. Norman Borlaug (1914-2009), who is widely recognized as the *Father of the Green Revolution* and leader of the 21st century movement to solve the world's hunger issues through scientific development and implementation.

Norman Borlaug, biologist, humanitarian, educator, agricultural leader and Nobel Laureate, was one of only seven people to receive the Nobel Peace Prize, the Presidential Medal of Freedom and the Congressional Gold Medal (alongside Martin Luther King, Jr., Elie Wiesel, Mother Teresa, Nelson Mandela, Aung San Suu

Kyi and Muhammad Yunus). Borlaug's core work in crop science – developing high-yielding, disease-resistant wheat varieties – greatly increased production in some of the world's most poverty stricken regions and effectively fed rapidly growing populations without demanding significant agricultural land extensification.

In 1964, Borlaug began 16 years of service as the first director of Mexico's International Maize and Wheat Improvement Center (Centro Internacional de Mejoramiento de Maíz y Trigo, or CIMMYT), where his efforts to develop higher yielding, disease-resistant, semi-dwarf wheat varieties helped grow Mexico from a low-yielding, wheat-producing and import-dependent country to a fully self-sustaining net exporter of the crop. His work with CIMMYT, where he continued as a senior consultant until his death in 2009, spawned similar innovations and radical changes in wheat and rice production in China, India and Pakistan – a global expansion that was dubbed the Green Revolution. In a published lecture given at IFDC in 2003, Borlaug said of the Green Revolution, “it symbolizes the process of applying agricultural science to develop modern techniques for Third World food production conditions.” He discussed the importance of a variety of factors dependent on improving food production, of which scientific and biological development was only a single element.

Borlaug created the World Food Prize – widely considered the Nobel Prize of the food and agriculture sectors – in 1986, in order to recognize the achievements of individuals working to solve and improve food production in the world's most destitute regions, and to serve as a means of education and a benchmark for establishing role models in the field. He also served as president and cofounder of the Sasakawa Africa Association.

Borlaug joined the IFDC board of directors in 1994 and served until 2003. Borlaug's presence and input to the Center underscored the important and significant role chemical fertilizers play in increased food production. “The advent of cheap and plentiful chemical fertilizers has been one of the great agricultural achievements of this century,” Borlaug wrote in the 1993 annual report for IFDC. He noted that because of increased availability and use of chemical fertilizers in Asia, food prices fell dramatically for both the rural and urban

poor. In that same report, Borlaug said, “Better use of existing technology is the answer to accelerate food production...while the public and private research entities try to unlock the potentials of molecular genetics and biotechnology.”

The loss of Dr. Borlaug in 2009 was not just a blow to IFDC and his other partners around the globe. It was a loss to civilization itself. Upon his passing, the IFDC board of directors issued a statement declaring Borlaug a pivotal and driving member of the organization and its accomplishments in Asia and Africa. IFDC President

**“If you desire peace, cultivate justice, but at the same time cultivate the fields to produce more bread; otherwise there will be no peace.”**

**– Dr. Norman Borlaug**

Dr. Borlaug's partnership with IFDC furthered the Green Revolution by attributing chemical fertilizer as a key element in better food production, alongside improved seed varieties, higher density planting, smart use of available and manufactured irrigation resources and careful management and improvement of soil fertility. Borlaug contributed to numerous IFDC publications and helped to qualify and verbalize IFDC's mission to enable smallholder farmers in developing countries to increase agricultural productivity, generate economic growth and practice environmental stewardship, in addition to enhancing their ability to manage mineral and organic fertilizers responsibly and participate profitably in input and output markets.

and CEO Dr. Amit Roy said, “Dr. Borlaug helped guide the organization out of the research laboratory to its field work across the agricultural value chain...we strive to spread the lessons of the Green Revolution to many areas of the world.” He noted that Borlaug was “not only a citizen of the world, but one of its bona fide heroes.” Borlaug's legacy continues as his research, developments and philosophies are integrated into rural communities in need of improving food production to obtain self-sustainability the world over.



▲ Dr. Norman Borlaug trains wheat researchers in Mexico. Part of Borlaug's legacy was his commitment to education and extension for young scientists. Photo courtesy of CIMMYT.

# IFDC Board of Directors/ VFRC Board of Advisors

IFDC is governed by a board of directors while the VFRC is governed by a board of advisors. Each board has representation from both developed and developing countries.

## IFDC



**Margaret Catley-Carlson**, patron of the Global Water Partnership (GWP) and member of the UN Secretary General's Advisory

Board on Water and Sanitation, served as discussant for "What is 'Healthy' Water? Interdisciplinary Perspectives on Water Security" at The Peter Wall Institute. Panelists from the three fields of science, medicine and the humanities debated our shifting understanding of water, health and disease, placing British Columbia issues in a global perspective. Catley-Carlson has served on IFDC's board of directors since 2006. She chairs the board's Budget Committee and is a member of the Executive, Audit and Nomination committees.



**Dr. Josué Dioné**, a member of the IFDC board of directors since 2011 and part of the board's Africa Committee,

recently became senior advisor to the African Union Commissioner for Rural Economy and Agriculture, **Rhoda Peace Tumusiime**, who is also a member of the IFDC board of directors. Dioné and Tumusiime are coordinating a set of major activities and events planned for the African Union's "2014 Year of Agriculture and Food Security in Africa." Dioné previously served as principal advisor, Policies and Markets for the Technical Centre for Agricultural and Rural Cooperation (CTA) and director of the Food Security and Sustainable Development Division of the United Nations Economic Commission.



**Peter McPherson**, chairman of the board of the Partnership to Cut Hunger and Poverty in Africa, delivered introductory

remarks at a seminar on "Powering Africa's Economic Development: A Conversation with Andrew Herscovitz" to discuss how power generation and distribution might be increased in Africa and lead to greater and inclusive agricultural and economic growth on the continent. Herscovitz is coordinator of the U.S. Power Africa Initiative and Trade Africa. The event was part of a series of dialogue, promoted by the Partnership, encouraging inclusive public-private partnerships in Africa. McPherson is chairman of the IFDC board of directors and has been a member of the board since 2004. He chairs the board's Executive Committee and is a member of the Nomination Committee. He is also a member of the VFRC board of advisors.



African Union Commissioner for Rural Economy and Agriculture, **Rhoda Peace Tumusiime**, participated in a panel discussion on "FDI, Economic

Growth and the Demands on Agricultural Land" during *The Economist's* 2014 Feeding the World Summit. The theme of the Summit was "Sustainable Solutions for a Global Crisis." In late 2013, Tumusiime was appointed to the Global Panel on Agriculture and Food Systems for Nutrition. Jointly funded by the United Kingdom government and the Bill & Melinda Gates Foundation, the Panel provides global research and policy leadership to maximize the contribution of agriculture and food systems to improve nutrition and health, particularly of women and children.



**Vo-Tong Xuan**, director of the Vietnam-Africa Agricultural Development Company and rector emeritus of An Giang University

in Vietnam, made two missions to Africa in January and February, first in Guinea where Xuan assisted a farm in suggesting a more sustainable approach in improving rice and rice-based farming systems in the Monchon and Mankountan areas. Xuan also visited Nigeria, where he assisted the agriculture faculty at Kogi State University to establish a Rice S&T course in their agronomy program curriculum and the Kogi State Accelerated Rice Production Program with funding from the state's own budget. Xuan has been a member of the IFDC board of directors since 2007. He chairs the board's Program Committee and is a member of the Executive, Africa, Budget and Nomination committees.

## VFRC APPOINTS NEW BOARD MEMBERS

In January, the VFRC appointed new members to its board of advisors, which now consists of 12 advisors from a broad range of fields.

- **Satish Chander**, director general of The Fertiliser Association of India.
- **Frank A. Franklin**, professor emeritus of public health at the University of Alabama at Birmingham.
- **Andrew Levin**, scaling team leader for the Office of Agricultural Resources and Policy, Bureau for Food Security, USAID.
- **Cheng-i Wei**, dean of the College of Agriculture and Natural Resources at the University of Maryland and director of the Maryland Agricultural Experiment Station and University of Maryland Extension.
- **Fu-Suo Zhang**, plant nutritionist and dean of the College of Resources and Environmental Sciences at China Agricultural University.

To learn more about these members, visit [www.vfrc.org/About/VFRC\\_Board\\_of\\_Advisors](http://www.vfrc.org/About/VFRC_Board_of_Advisors).



**Satish Chander**, director general of The Fertiliser Association of India (FAI), which provides support for

meeting the challenges of the country's fertilizer industry, led the 2013 FAI Annual Seminar in New Delhi, India. The 2013 focus was "Fertiliser Sector at Crossroads," with discussions on improving operative efficiency, modifying pricing policies to encourage balanced fertilization, better use and delivery of fertilizer and implementing improved agricultural practices. Chander became a member of the VFRC board of advisors in January 2014.



**Marco Ferroni**, executive director of Syngenta Foundation for Sustainable Agriculture (SFSA),

participated as a speaker at the GLOBE 2014 Conference in Vancouver, British Columbia, on the Food and Water Security in a Changing World forum. SFSA recently released its latest *Review, 2012-2013*, which can be accessed at [www.syngentafoundation.org](http://www.syngentafoundation.org). The publication touches on several development topics, such as the importance of business plans for smallholders and the market tool Farmforce's ability to reduce risk. Ferroni has been a member of the VFRC board of advisors since 2010.



**Juergen Voegele**, director of Agriculture and Environmental Services at the World Bank, delivered the keynote

address at the 3<sup>rd</sup> Global Conference on Agriculture, Food and Nutrition Security and Climate Change in Johannesburg, South Africa. The conference served as a platform for global leaders, practitioners, scientists, farmers, organized agriculture, civil society, the private sector and NGOs to discuss and share experiences

on successes and to deliberate the challenges and threats to food and nutrition security under the impact of climate change. Voegele has been a member of the VFRC board of advisors since 2010.

## IFDC Staff News

IFDC attendees to the Argus FMB Africa Fertilizer 2014 conference in Marrakech, Morocco, included **Patrice Annequin**, senior market information specialist; **Kofi Debrah**, chief of party (COP) of USAID WAFP; **Solomon Duah**, USAID WAFP communications officer; **Rob Groot**, director of ESAFD; **Susan van Keulen-Cantella**, NWAFFD senior portfolio manager; **Paul Makepeace**, senior scientist - marketing and senior agribusiness advisor for the African Fertilizer and Agribusiness Partnership (AFAP); and **Charles Pouliot**, grants manager and deputy COP of USAID WAFP. Annequin and Debrah participated in a panel discussion on "The African Fertilizer Industry," and Groot gave a presentation titled "Feeding Two Billion People - Future Nutrient Market in Sub-Saharan Africa."

**Prem Bindraban**, VFRC executive director, attended the 3<sup>rd</sup> Global Conference on Agriculture, Food and Nutrition Security and Climate Change in Johannesburg, South Africa, where he gave a presentation on "Fertilizer Solutions for Global Food Security and the Environment." The conference focused on challenges and threats to food and nutrition security resulting from the impact of climate change. Novel fertilizers can make a substantial contribution to address these challenges.

**Oumou Camara**, senior scientist - economics and country representative to Ethiopia, delivered a statement on behalf of African Union Commissioner for Rural Economy and Agriculture, Rhoda Peace Tumusiime, during the High Level Dialogue for the Initiative to Empower Women in Agriculture, held in Addis Ababa, Ethiopia. The event underscored the important contribution of women in agriculture, food security and poverty reduction and how women can be empowered through access to productive assets.

**Ishrat Jahan**, IFDC country representative to Bangladesh and AAPI project coordinator, participated in a panel discussion on policy support for

scaling up technology adoption during the Feed the Future Global Learning and Evidence Exchange (GLEE) on Scaling Agricultural Technologies. The event was held in Bangkok, Thailand, and focused on strategies for advancing agricultural innovations in Asia.

ESAFD held a monitoring and evaluation (M&E) workshop in Nairobi, Kenya, to share knowledge about the field of M&E and discuss how to better collaborate in the future. M&E specialists from various projects in the region attended: **Aniceto Matias**, **Carine Rukera**, **Martin Hakizayezu**, **Arasto Mujungu** and **Loic Nsabimana**. The main outcome of the workshop was the founding of a Technical Working Group intended to spark future collaboration and training. The temporary coordinator for the group is **Willem Selen**, IT and M&E consultant. The workshop was organized by **Denis Tiren**, portfolio manager, Kenya.

IFDC president and CEO, **Amit Roy**, gave a presentation on FDP technology at the Global Forum for Innovations in Agriculture (GFIA) in Abu Dhabi, United Arab Emirates. Roy also participated in a panel discussion on "Africa: The Frontier for Arid Farming." During the event, **Clyde Beaver**, communications specialist, and **Rieke Weel**, ESAFD regional development communications officer, organized and managed an exhibit highlighting IFDC initiatives. In addition, Beaver attended an International Fertilizer Industry Association (IFA) communications workshop on agriculture and research innovation in Paris, France.

**Steven J. Van Kauwenbergh**, principal scientist and project leader of IFDC's Phosphate Research and Resources Initiative, participated in a panel discussion during the USDA Agricultural Outlook Forum in Washington, D.C. Van Kauwenbergh focused on phosphorus resources during the session, titled "Sustainability - Are We Applying Our Critical Inputs Wisely?"

**Maria Wanzala**, senior policy economist seconded to NEPAD, participated in a panel discussion on "Fostering Opportunities for Increased Fertilizer Inputs in Africa" during the 6th International Nitrogen Conference held in Kampala, Uganda. A 'mini-declaration' on fertilizer policy and market development was issued at the conclusion of the discussion. Over 150 delegates from more than 30 countries attended the conference, which focused on the role of nitrogen management in food security, human health, agriculture and the water cycle.



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ISSN 0149-3434



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## 2014 International Training Calendar

Training Program/Workshop/Study Tour	Dates	Location	Program Fee
Fertilizer Value Chain – Supply System Management and Servicing Farmers' Needs	April 14-18	Accra, Ghana	\$1,500
Developing Private Sector Agro-Input Markets: Designing and Implementing Targeted Input Subsidies (French Edition)	May 5-9	Dakar, Senegal	\$1,500
Agricultural Market Information Systems and IT Platforms for Business Management Across the Value Chain	June 2-6	Nairobi, Kenya	\$1,500
Linking Farmers to Markets in Africa (French Edition)	July 7-11	Bamako, Mali	\$1,500
Technology Advances in Agricultural Production, Water and Nutrient Management	August 18-29	Alabama, Tennessee, Missouri, Arkansas, Iowa and Washington, D.C. (United States)	\$2,200
Nutrient Delivery Strategies – FDP and Blending Opportunities in Africa	October 6-10	Pretoria, South Africa	\$1,500
Granular Fertilizers Production	November 3-7	Bangkok, Thailand	\$1,900
Promoting Innovative Composting Alternatives of Agricultural and Municipal Waste	November 24-28	Accra, Ghana	\$1,500
Fertilizer Marketing Strategies: Improving Efficiency in Pricing, Product Management, Technology Promotion and Logistics	December 15-19	Jakarta, Indonesia	\$1,900