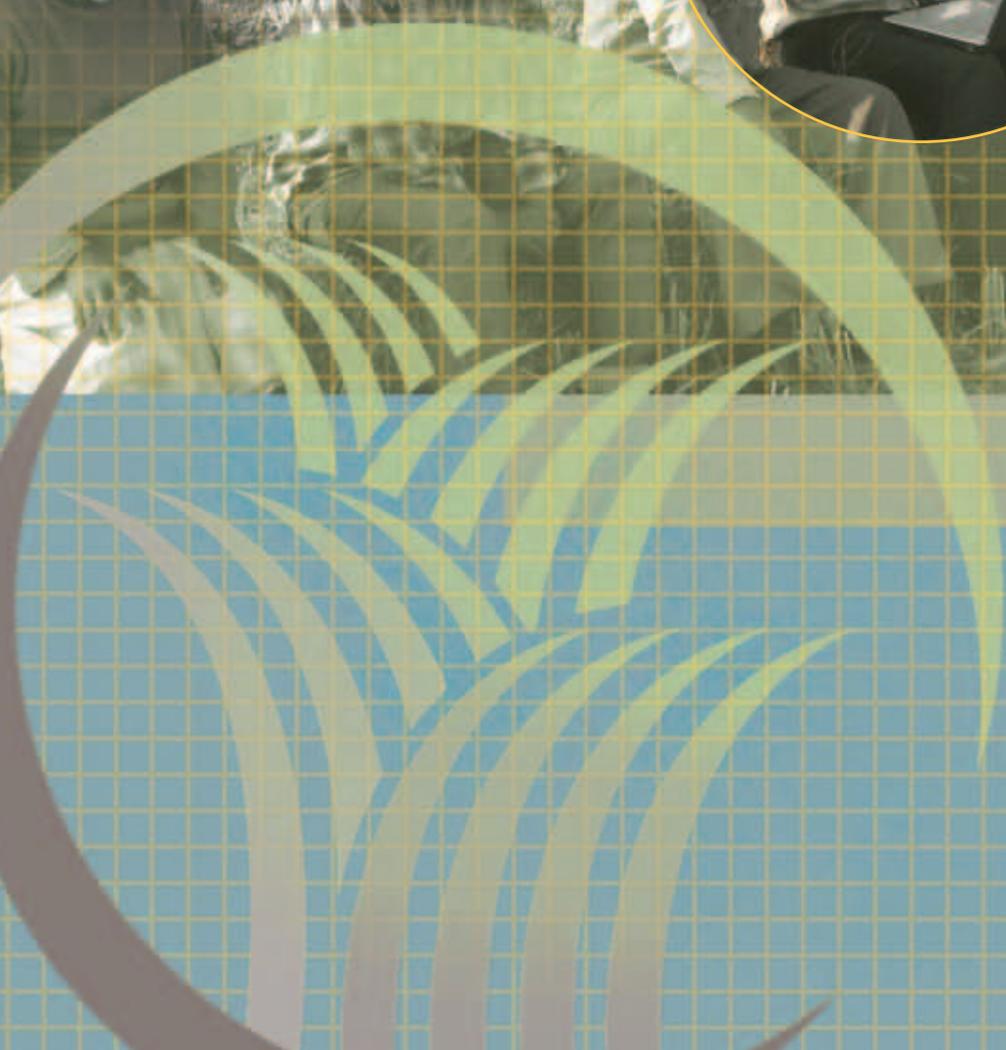


INTERNATIONAL
PLANT
NUTRITION
INSTITUTE

Program Report 2012



The mission of IPNI is to develop and promote scientific information about the responsible management of plant nutrition for the benefit of the human family.

MEMBERS: Agrium Inc.
Arab Potash Company
Belarusian Potash Company
CF Industries Holdings, Inc.
Compass Minerals Specialty Fertilizers
Incitec Pivot
International Raw Materials LTD
Intrepid Potash, Inc.
K+S KALI GmbH
OCP S.A.
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Simplot
Sinofert Holdings Limited
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The Mosaic Company
Uralkali
Vale Fertilizantes S.A.

AFFILIATE MEMBERS: Arab Fertilizer Association (AFA)
Associação Nacional para Difusão de Adubos (ANDA)
Canadian Fertilizer Institute (CFI)
Fertiliser Association of India (FAI)
International Fertilizer Industry Association (IFA)
International Potash Institute (IPI)
The Fertilizer Institute (TFI)

Telling Our Story

IPNI lives in a world of scientific facts and agronomic information, of data—bits and bytes waiting to be applied, or yet to be developed. We are always looking for ways to tell our story. Almost half of our resources are devoted to communication and educational activities ... to telling our story.

Storytelling is the art of conveying events or messages through word, images, and sounds, often aided by ad-libbing or embellishment. Stories have been used throughout history and in every culture to entertain, to inform, and to educate. So what's our story?

Simply stated, IPNI's story of plant nutrition has evolved into 4R Nutrient Stewardship. All of our key messages, all of the issues we deal with, whether they be related to food security or nutrient use efficiency or environmental responsibility, can be addressed within the concept of the 4Rs—apply the right source of nutrient, at the right rate, at the right time, and in the right place.

4R Nutrient Stewardship is a great story. It is the best way to manage fertilizer and other plant nutrients. It considers the economic, environmental, and social dimensions of managing nutrients. It is based on facts, on scientific knowledge ... there is no need, nor room for embellishment. We have partnered with the International Fertilizer Industry Association (IFA), The Fertilizer Institute (TFI), and the Canadian Fertilizer Institute (CFI) in 4R messaging. IPNI is providing supporting science and we are all working together to tell the 4R story.

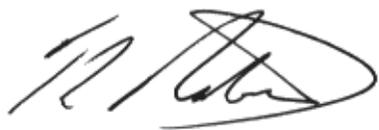
IPNI has a long history of telling the appropriate story. Our communications group is actively developing new materials every day. Last year IPNI editorial completed 125 jobs, or about one every other working day. This includes everything from putting out our *Better Crops* magazine to scientific papers to tweets. But, it does not include the multitude of information that is posted to our websites weekly by our scientific staff. Our communications group is small—only four staff—but they are backed up by 30 scientists.

We can't separate science from education. This past year we provided financial or in-kind support to more than 150 research and demonstration projects around the world. Financed only partially by IPNI, the total cost of these projects was estimated at almost USD 12 million. Some of these projects are local, for example, studying nutrient management strategies in greenhouse vegetable production in the suburbs of Shanghai. Others are regional like the Cereals Systems Initiative in South Asia, which aims to develop and implement site-specific nutrient management in rice-wheat cropping, and others cover multiple countries like our global maize project. Its objective is to identify and close the yield gaps in maize production using improved management technologies.

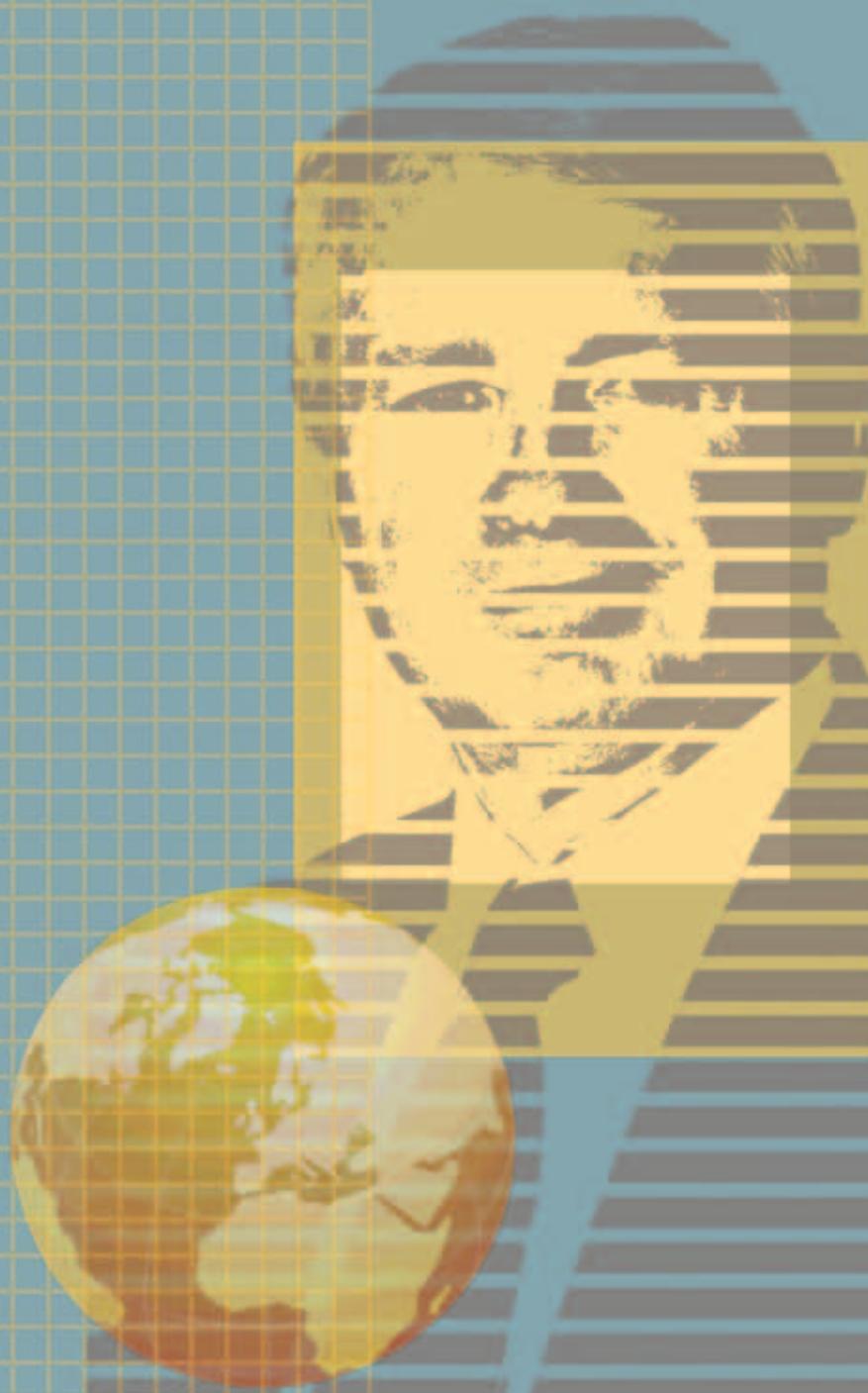
Results from these projects, and that from other related research, provide the fuel for the stewardship stories we tell. It's a team effort. Our scientists work with our editorial staff to develop and produce the messages that show that fertilizer feeds the world, that fertilizer is part of the solution, that 4R Nutrient Stewardship is the way forward.

IPNI scientists are engaged in nutrient management issues globally. We are a small team, but we collaborate with many scientists, institutions, and governmental departments throughout the world. The professional relationships we have developed are vital to getting our message out and getting it implemented in the field.

This annual report will highlight our most recent activities and programs. More detailed information is available from our regional scientific staff.



Terry L. Roberts, Ph.D.
President



We are always looking for ways to tell our story. Almost half of our resources are devoted to communication and educational activities ... to telling our story.



Concern over the environmental impact of sustainable nutrient use has undoubtedly been a major factor in the industry promotion of 4R Nutrient Stewardship.

Americas and Oceania Group

Dr. Paul Fixen

Senior Vice President,
Americas and Oceania Group,
and Director of Research

Technology aimed at facilitating communication has been evolving at amazing speed and is now accessible in most regions of the Americas and Oceania. Seldom do you encounter more than temporary lapses in mobile communication device functionality. Still, communication remains a major challenge as one struggles to be heard over the cacophony of messages to which most audiences are exposed. Clearly focusing on a specific message or approach and reaching out to partners who share support of that message are important tactical aspects of IPNI programs. As Dr. Roberts mentioned, 4R Nutrient Stewardship has become a major thrust in IPNI programs including those of the Americas and Oceania. We have found 4R Nutrient Stewardship to be a powerful communication tool and an effective framework to guide IPNI and industry efforts in managing many nutrient related issues. You will see it running through many of the activities mentioned in this report.

Concern over the environmental impact of sustainable nutrient use has undoubtedly been a major factor in the industry promotion of 4R Nutrient Stewardship. However, it is critically important to fully appreciate that the environmental, economic, and social pillars of sustainability are inseparable. This means that meeting the increasing global societal needs for food, fiber, fuel, and other ecosystem services will continue to be emphasized in the scientific research and educational programming of IPNI. Increased emphasis on 4R Nutrient Stewardship in IPNI programs does not diminish our emphasis on productivity, but rather facilitates our ability to show the connection between productivity and the three inseparable pillars of sustainable development.

North America

In 2011, our North American staff worked closely with other industry organizations such as TFI, CFI, and IFA as well as scientific societies, universities, and NGOs to promote the science behind the 4Rs. One such effort was the Nutrient Stewardship Summit held in Chicago and organized through a coalition assembled by TFI that included, in addition to IPNI; CFI, the Ag Retailers Association (ARA), and the American Society of Agronomy Certified Crop Adviser Program. The meeting brought together a good cross section of the industry and increased awareness of 4R industry programs, advancing industry's ability to speak with one voice on nutrient stewardship. We received good input on our *4R Plant Nutrition Manual* and observed that many in the industry were anxiously awaiting its completion. Drs. Bruulsema, Snyder, and Fixen all made presentations at the meeting.

InfoAg Conference

InfoAg is the largest educational meeting organized by IPNI in North America and was held in 2011 in Springfield, Illinois. It is a conference designed to educate those that provide or use precision ag technologies and approaches. This was the tenth InfoAg in the long-standing series which dates back to 1995. We partnered with Crop Life Media Group in conducting the conference. Feedback from the more than 700 attendees touted the conference as a great success. **Dr. Steve Phillips**, chair of IPNI's Spatial and Temporal Working Group and Southeast Director, was our staff lead for organizing the event.

InfoAg offers an opportunity to present 4R Nutrient Stewardship within the context of right-intensively managed systems that employ the best technologies and management practices our current industry and science can provide. Right source, rate, time, and place form the center core of the 4R Nutrient Stewardship framework, however, between these 4Rs and a myriad of performance indicators of interest to stakeholders, is the "cropping system". The need for and "performance" of nutrient sources

is greatly influenced by the quality of management of the cropping system in which they are used. Dr. Phillips states that precision ag is 4R stewardship and that being "precise" with input management basically means getting it "right".

NuGIS

Nutrient balance indicates whether soils are being enriched with nutrients or depleted. It can be evaluated at a variety of scales, ranging from an area within a field all the way up to a watershed. It is a key measure of nutrient management performance and therefore part of 4R nutrient management. IPNI has developed a tool called *NuGIS* (Nutrient Use Geographic Information System) to assess and monitor nutrient balance across the U.S. The U.S. was chosen as an initial area of focus because of the availability of the data necessary to perform the balance calculations. NuGIS is an interactive web-accessible tool, allowing users to look at a variety of scales and time periods from any computer connected to the internet. The first version of this was released late in 2011. Considering the complexity of today's environment with input and commodity price volatility, changes in seed technology, and ever chang-

ing and improving production systems, it is critical to understand the current status of nutrient balances, temporal trends of those balances, and how these are related to nutrient use efficiency. Awareness of the importance of cropland nutrient balance is growing across North America, sometimes driven by environmental concerns associated with nutrient inputs greatly exceeding outputs, but also by concern that negative balances (outputs exceed inputs) will result in future declines in productivity. IPNI staff have been introducing audiences to NuGIS and pointing out situations where nutrient balance is moving in directions that do not appear to be sustainable.

The NuGIS project is also showing us where weaknesses exist in our ability to estimate nutrient balances—areas scientists previously thought were fairly well defined. An active area of IPNI efforts is to improve the estimates of nutrient concentrations in harvested crops. While tables of these values have been published by IPNI and its members for many years, investigations are showing that substantial improvements need to be made to improve accuracy, and that local variations can be significant.

Dr. Steve Phillips, Southeast Director, and Dr. Reza Ehsani, University of Florida, display an unmanned aerial vehicle used to detect spatial variability in citrus and oil palm.



P and K Fellowship Programs

IPNI coordinates an industry-funded K Fellowship program at Purdue University and a P Fellowship program at Kansas State University. The objectives of these programs are to advance the science supporting use of P and K and to increase the supply of researchers experienced with that science. The P program includes a rather basic component using new methodologies to evaluate P transformations in fertilized soils. Recently, this has included soils from other IPNI regions involving support from **Dr. Raúl Jaramillo**, Northern Latin America Director, who supplied soil from Ecuador for the study. The programs are nearing the end of the commitment period for the industry supporters and so discussions are under way with them concerning the future of the programs. Several fellows of the program are actively working in agriculture and many scientific advancements have been made. As the program comes up for renewal, discussions are underway on how to improve upon the initial concept to ensure the program is well positioned to keep up with the many

changes in funding and program structures at universities. Dr. Scott Murrell, Dr. Mike Stewart, and Dr. Fixen are coordinating those discussions with industry to brainstorm innovative approaches that ensure that highly knowledgeable and capable scientists continue to be produced by the program.

North America Regional Highlights

Nutrient best management practices (BMPs) are based on university recommendations, either directly or indirectly. IPNI staff work closely with the scientists who develop those recommendations. IPNI's influence comes primarily from exchanges of innovative ideas and approaches. In the Corn Belt, many university scientists are comparing their historically different approaches to find commonality. A group of scientists is meeting formally to have these discussions. **Dr. Scott Murrell**, Northcentral Director, was invited to work with this group and has been asked to help them determine how their divergent approaches relate back to the scientific principles of making a N recommendation. This linkage is key to making future



Dr. Scott Murrell, Northcentral Director.

improvements. The group plans to produce a white paper and to conduct a symposium at the upcoming American Society of Agronomy Annual Meeting. These planned activities are typical for scientists who are actively creating



Dr. Raúl Jaramillo, Northern Latin America Director, during a field day.

new ideas. Dr. Murrell is also organizing another symposium that will bring together scientists who are coming up with innovative approaches for improving economic assessments of nutrient recommendations.

Of the major nutrients, K has a unique challenge. Science has not been able to come up with a soil test that is as precise or accurate as the one for P. Consequently, it is difficult to assess the true K fertility of soils. Scientists in the U.S. Midwest are conducting research to investigate possible improvements. For many years, Drs. Murrell and Fixen have been working with Iowa State University and Purdue University, and scientists at these institutions have become leaders in this field. Recently, this long-term investment by IPNI has led to new insights into why the K soil test is so variable. Improved approaches, technologies, and analysis techniques are under development and results are encouraging. IPNI and university scientists continue to work together to make advancements and educate people who regularly rely on this information.

Harvesting of crops for biofuel feedstocks has the potential to remove large quantities of N, P, and K. It is important for the fertilizer industry to understand just how great these removal rates could be, because they will have to be replaced to maintain soil fertility. Dr. Murrell is working with USDA-ARS scientists to assess crop nutrient removal rates under several different production scenarios. An updated report from the USDA and Department of Energy is being reviewed and assessed, and calculations of nutrient removal are being determined.

Many farmers have observed that their soybean yields have reached a plateau. Farmers do not regularly manage this crop with the level of detail that they do maize or wheat. Soybeans are typically planted into fields that have had fertility managed for the other crops in the rotation. Dr. Murrell has been identifying the unique nutritional needs of soybean and sharing these findings with scientists, crop advisers, and farmers. Of particular interest has been the placement

Dr. Mike Stewart, Southern and Central Great Plains Director, during Great Plains Soil Fertility Conference.



of P and K relative to the soybean root system and how this placement differs from cereal crops. Dr. Murrell recently educated over 250 top farmers in a high yield workshop. Additionally, he has been using a new crop simulation model, SoySim, that was developed through partial support from IPNI. SoySim is an important tool for estimating potential yield and the gap between that potential and what farmers typically achieve.

North America has a long-standing tradition of periodic regional soil fertility conferences where Extension and industry agronomists meet to discuss new research and field problems. IPNI helps administer several of these conferences and our staff serve on program committees. This year, **Dr. Mike Stewart**, Southern and Central Great Plains Director, chaired the program committee for the Great Plains Soil Fertility Conference. It has the reputation of being the premier soil fertility and crop nutrition event in the region. The conference offers the opportunity to highlight issues of concern to the fertilizer industry with presentations from several IPNI staff.

The Great Plains region offers a challenging climate for crop production, including sometimes severe climatic and soil limitations. In 2011, an unprecedented drought occurred in the

southern part of the region. The severity of the drought and its impact are reflected in the fact that dryland crops in some areas of the region completely failed. This has raised questions about how to fertilize after such an extreme year. Dr. Stewart helped address these questions by co-authoring with university faculty an IPNI *Insights* newsletter on this current critical issue. Most of the region is naturally high in soil K, but some states have comparatively low soil P levels. Where NuGIS has uncovered negative P balances for croplands, Dr. Stewart has and will continue to work to heighten awareness of the problem and help the industry and growers implement solutions.

The overall greatest concern for nutrient management in the Northern Great Plains is that the export of nutrients in harvested and exported crop grains and products is greater than nutrient replacement using fertilizer or recycling of livestock manures. This has caused **Dr. Tom Jensen**, Northern Great Plains Director, to emphasize improved nutrient balance so replacement will grow and approach nutrient removal.

At the same time, Dr. Jensen's program addresses the need to improve fertilizer use efficiencies by adoption of management practices that increase crop use and reduce losses to the environment, including nitrous oxide emissions.



Dr. Tom Jensen, Northern Great Plains Director, in wheat field.

Dr. Rob Mikkelsen (right), Western North America Director, with Luke Thurgood (left), reviewing root growth bins.



The focus is on practices applying the 4R Nutrient Stewardship Principles. As in all IPNI regional programs in North America, the Certified Crop Adviser Program (CCA) is a major audience for our educational activities in the Northern Great Plains.

Production of high yielding and high quality crops is a priority in the Western Region of North America, but it is also an area with intense concerns about agricultural impacts on the environment that often manifest themselves in regulations. **Dr. Rob Mikkelsen**, Western North America Director, spends much of his time on the science that can improve the compatibility of these regional priorities. For most crops, maintenance of adequate soil nutrients remains important for farmers. However, there are areas where nutrient budgets are negative (mining the soil) and other areas where nutrient accumulation is occurring in soil. Nutrient buildup can be a useful outcome of fertilization as long as management practices are implemented so losses and any adverse environmental impacts are minimized. Balanced nutrition remains an issue of concern throughout the region. Environmental issues are growing in importance, especially in California. The California

state water quality boards are in the process of implementing restrictions on how N fertilizer can be used in order to further protect surface and groundwater. The California air resources board is implementing regulations aimed to reduce the quantity of nitrous oxide lost from agricultural soil.

The 4R initiative has resulted in heightened awareness of the core

principles. However, considerable work still remains to educate users on the decision process required to apply the 4R concepts in each individual field. The next stage of 4R implementation will include development of case studies and useful tools to apply the theoretical concepts of 4Rs. Educational material is being developed on the interaction between nutrient management and water use efficiency. This will assist growers in utilizing two valuable resources to their maximum benefit.

In the Northeast Region of North America, the educational and promotional efforts of **Dr. Tom Bruulsema**, Northeast North America Director, have been a major factor in making the 4R Nutrient Stewardship concept recognized by a wide range of government officials and agents, and university faculty. Its principles are being more and more widely incorporated into public and private extension programs promoting BMPs. The aim is a more transparent and better validated connection to sustainability performance. For example, Dr. Bruulsema has applied 4Rs to a water quality problem in Lake Erie that has been associated with P use. He has participated with TFI, The Andersons, Morral Companies, and the Nature Conservancy to apply 4R principles and made presentations to agri-retailers and producers in Ohio raising awareness about the importance of P placement.

The Northeast Region in the past has had highly positive crop nutrient balances; however, recent data indicate shifts have occurred. Articles on crop nutrient balances based on NuGIS output and soil test summary information have been assembled by Dr. Bruulsema, at <http://nane.ipni.net>, to correct misperceptions regarding nutrient surpluses in agriculture. These articles have been widely downloaded and have shown up frequently in farm press.



Dr. Tom Bruulsema, Northeast North America Director, checking soybean plants in Ontario, Canada.

The IPNI program in the Southeast U.S., led by Dr. Steve Phillips, is currently focused on the integration of precision agriculture technologies and management strategies into the 4R Nutrient Stewardship framework. Precision agriculture is a rapidly growing component of nutrient management in the Southeast. Many of the climatic, logistic, and regulatory challenges growers face when managing nutrients in this region can be addressed using various components of precision agriculture. Current research and outreach programs are increasing efforts to provide guidelines on precision nutrient management. Nitrogen management has always been a focus in this region since soil testing for available N is not an option in the Southeast due to the climate, soils, and fluctuating water tables. So, most N recommendations rely on some aspect of expected yield level or regional productivity averages and these approaches fail more often than not due to extreme weather variability from year to year.

An issue of more recent concern is a significant drop in P and K use in the region. What makes this a concern from an agronomic perspective is that the IPNI soil test summaries show significant drops in the median P and K soil test levels in many of the states in the region—for example, K levels in the Mid-Atlantic and Southeastern Coastal Plain (North Carolina, South Carolina, Georgia). Little yield loss has been verified as a result; however, increased incidences of K deficiency in cotton as well as increased leaf disease (often indicative of K problems) are beginning to be observed.

Latin America

Across Latin America, communicating science-based information on contemporary plant nutrition issues is a critical function of IPNI programs. Each of our Latin America regional programs has traditionally published their own quarterly newsletters that have been widely read. However, mailing and printing costs have markedly increased over the last few years. To be able to reduce these costs, in 2011 the three Spanish speaking IPNI regions pooled their

efforts and now produce a single quarterly newsletter, *Informaciones Agronómicas de Hispanoamérica*. The electronic version of the newsletter now has over 6,000 subscribers across all Latin America. This is now a collaborative effort among the three IPNI offices covering the Spanish speaking countries. We expect to further

increase our list of subscribers and confirm *Informaciones Agronómicas* as a leader in updated nutrient and agronomy related information. Our Brazil program continues to publish *Informações Agrônômicas* in Portuguese.

Midway through 2011, **Dr. Armando Tasistro** assumed full time responsibility for IPNI programs in Mexico and Central America. One of his major activities in the region has been a cooperative effort with the International Maize and Wheat Improvement Center (CIMMYT) called



“Take it to the Farmer”. It is said that shortly before his death, when Dr. Norman Borlaug was told about the developments being made on the use of sensors to manage the N nutrition of crops, he commented “Take it to the farmer!” Those words are now the name and motto of an ambitious project by the Mexican

Government aimed at the sustainable modernization of Mexico’s traditional agriculture. The project is being coordinated by CIMMYT and organized around innovation hubs that will be established in seven agro-ecological regions. The specific studies in each hub will be defined by experts organized in six work-groups: 1) Management of the nutrition of wheat and maize, and aspects related to climatology, 2) Strategic research for the adaptation and adoption of Conservation Agriculture, 3) Machinery development, 4) Integral extension strategy,

Dr. Armando Tasistro (standing far left), Mexico and Central America Director, taught Soil Fertility Management to a group of enthusiastic Mexican agronomists as part of a 2-day course required to be certified as Adviser on Conservation Agriculture.



Dr. Fernando García, Latin America-Southern Cone Director, field day at Gral Baldissera.



5) Training, and 6) Impact and focusing. IPNI has a major role in the crop nutrition workgroup.

Dr. Tasistro has been working with partner organizations to provide traditional courses to agronomists and farmers, but plans to offer webinars in the near future on soil acidity, nutrient management under conservation agriculture, and nutrient balance. Research in the region includes continuing the evaluation of ecological intensification alternatives in Mexico with two experiments that are part of IPNI's Global Maize Project. Sulfur and zinc are limiting in large areas of Mexico, and a study at several locations will be started in 2012 to establish BMPs. Studies aimed at determining agroecological conditions where K is limiting crop productivity will be started in Mexico and Honduras and on sugar cane in Guatemala.

In Northern Latin America, as an alternative for soil testing to produce fertilizer recommendations, our research partners in Colombia and Ecuador (FENALCE and INIAP) have implemented site-specific nutrient management (SSNM). In this effort our Northern Latin America Director, Dr. Raúl Jaramillo, and program partners work with small farmers to use local crop response and

omission plots to measure yield gaps and calculate nutrient needs. Thanks to these efforts, two publications were produced in each country in the last 3 years summarizing differences across Colombia and for the central highlands in Ecuador. These activities continue and we expect to engage new partner organizations in Ecuador and expand the use of this low-cost and effective approach to other crops and regions. Dr. Jaramillo is also coordinating a Global Maize location in Buga with FENALCE. This study is now going into the fifth crop cycle and showing large and significant differences among N management strategies.

Most banana growers in Ecuador used to rely on relatively small amounts of N and K fertilizer only and yet have large harvests, due mostly to the very good initial soil properties. With the support of INIAP and local companies, our Northern Latin America program has carried out research that shows the importance of balanced nutrient management to replenish soil nutrients together with careful agronomic management. Dr. Jaramillo has shown initial results to companies and growers in the region and expects to carry out one last year of



activities to produce books and reports for a broader audience.

Oil palm has become an exciting crop for the Northern Latin America Region. Local governments and private companies are now investing in biodiesel from oil palm. Governments have also noticed that oil palm, with adequate management, can provide an escape from poverty for growers with more than 10 ha of cropland. Because of this, oil palm is probably the crop with the larger expected increase in planted area and yield in the region. Proper nutrient management is essential to achieve stable and high yields. Dr. Jaramillo has started activities in Ecuador and Colombia with research partners and farmer guilds, in order to implement i) local fertilizer trials, and ii) measure the demands of new planting material that are only found in Latin America. We expect to implement several fertilizer trials across Ecuador, Colombia, and Peru, and characterize the nutrient management of novel planting materials. Our Northern Latin America office plans to release a book on the management of oil palm during the first quarter of 2012.

The Southern Cone Region, led by **Dr. Fernando García**, has recently emphasized the development of research and educational programs on balanced fertilization following 4R Nutrient Stewardship in collaboration with member companies, national institutes of agriculture of the region, universities, farmer organizations, associations of agronomists, and others. Face-to-face meetings remain a critical component of educational efforts in this region with Dr. García holding a total of 80 meetings with an estimated audience of 10,743 participants in the last three years. Good examples of such meetings in 2011 were the 2011 Soil Fertility Symposium which attracted an audience of 861 participants and the internationally respected nutrition module of the AAPRESID (Argentina No-Till Farmer Association) Congress which had 550 agronomists and farmers in attendance.

The Argentinean chapter of the Certified Crop Adviser (CCA) program of the American Society of Agronomy (ASA) was launched in 2011 at the Ministry of Agriculture in a meeting that was chaired by the Argentine Secretary of Agriculture. As interim chairman of CCA-Argentina, Dr. García introduced CCA and gave an update on the advances in establishing the program. The CCA program will contribute to improved education and professionalism of Argentina agronomists through ASA standards of knowledge, experience, and ethics. The first CCA exams are expected to be given in 2012.

Two of the centers for the IPNI Global Maize project are located in Argentina



Dr. Luís Prochnow, Brazil Director, speaking before a member company group.

on INTA research stations near Balcarce and Parana. A major positive development for this research was the successful pursuit by Dr. García and our research partners of a Ministry of Science and Technology of Argentina substantial grant supporting the measurement of greenhouse gas emissions and leaching losses. This will provide a data set where the full impacts of ecological intensification of maize-based cropping systems can be monitored.

Our program in Brazil continues to grow with the IPNI Board in 2011 deciding to add a third staff position to help accelerate development of efficient fertilizer use in this country. The world expects much from Brazil in the future in terms of increased food production and the science-based guidance IPNI programs provide will play a critical role in meeting those expectations.

Dr. Luís Prochnow, Director, and **Dr. Valter Casarin**, Deputy Director, have been conducting a multi-phase effort to increase the adoption of fertilizer BMPs for 4R Nutrient Stewardship. This program was started with a pivotal symposium on the topic in 2009 (phase 1), continued with the publication of a three volume book on the topic in 2010 (phase 2) and now our staff are conducting regional symposia all over the country (phase 3). The published book serves as the base publication for the events. The program for each symposium is adapted for each

Dr. Valter Casarin, Brazil Deputy Director, observes soybean plants in Mato Grosso State.



situation in terms of crops and regional needs. Related research in the program is focused on defining the best suited cropping systems for each region in the country, which leads to higher nutrient use efficiency and farmer profitability.

As is the case in North America, the balance between nutrient inputs and outputs is receiving increased attention in Brazil. IPNI evaluation of nutrient budgets indicates that, although Brazil is doing reasonably well in terms of nutrient use efficiency, there are some specific areas that need great attention as to not





deplete their soils in terms of soil fertility. The nutrient budget evaluation is a way to identify the regions and crops with low nutrient use. Subsequently, the actions of symposia and research in these areas aim to show the importance of nutrients to increase crop production.

Oceania

Dr. Robert Norton, Australia and New Zealand Director, has been maintaining

Dr. Robert Norton, Australia/New Zealand Director, presenting at Horticultural Nutrition Master classes in Australia.



an active presence at industry meetings promoting the science behind nutrition and continuing to assist younger scientists in developing relevant and well designed research projects, and to demand rigor in product assessments. This approach resulted in the release of 4R Management Guides for N and P on Wheat. Continuing efforts on the effects of climate change on wheat and pulse crop growth and development, including N cycling, is improving our understanding of the effect of climate change on future nutrient demand. The collaborative project Better Fertilizer Decisions for Crops has now seen over 5,000 field trials entered into a searchable database that can be used to estimate critical soil test values, and a new project on K and P placement in subtropical grain cropping systems was commenced with the University of Queensland in the northern grains region.

Nitrogen Program

Dr. Cliff Snyder directs our Nitrogen Program and divides his time among the numerous environmental issues impacting N use. In December 2010, many of these issues came together at the 5th International N Conference held in New Delhi. The Conference was attended by more than 450 delegates from 37 coun-

tries and was organized by the International Nitrogen Initiative (INI) and the India Nitrogen Group to address issues of N and food security, climate change, ecosystem health and diversity, energy security, industry, and integration. Since that IPNI co-sponsored event where IPNI was well represented through nine scientific presentations delivered by several of our regional directors, conference organizers and many participants praised the quality of IPNI's presentations and the integrity of the science represented, and expressed appreciation for IPNI's support. Dr. Snyder continues to serve on the Science Advisory Committee and has initiated communication and coordination with Dr. Shamie Zingore, Africa Director, since the 6th International Nitrogen conference will be held in Africa, likely in October of 2013. A "Declaration on Reactive Nitrogen Management for Sustainable Development", representing the consensus opinion of the conference participants, was distributed to the conference participants, global food and environmental sustainability organizations, and policymakers. The necessity of fertilizer N for food security was noted in the Delhi Declaration, along with a call for better N management to reduce leakages which exacerbate disturbance of

the N cycle. IPNI and IFA staff worked together in the negotiation process during the development of the Declaration, resulting in a more balanced approach. That Declaration was posted to the IPNI website, as well as each of the papers presented by the IPNI staff scientists.

Numerous activities in 2011 involved **N effects on water quality**. Among them were the following.

- Illinois Keep It for the Crop by 2025 (KIC) Program. This is a unified education and research program developed through the leadership of the Illinois Fertilizer and Chemical Association (IFCA) with collaboration from numerous agricultural, environmental, and agency groups with the objective of improving acceptable water quality in six priority watersheds. Drs. Snyder and Murrell provide technical and advisory support to KIC leaders. The 4R Nutrient Stewardship is being interwoven throughout the project to achieve economic, social, and environmental benefits. This project is setting a national example of industry working with farmers to refine nutrient management practices, to help avoid potential nutrient use restrictions, which could emanate from federal or state-imposed water quality numeric nutrient criteria. This project will be a critically important test case for the voluntary implementation of changes in nutrient BMPs to improve water quality in the U.S.
- Association of State and Interstate Water Pollution Control Administrators (ASIWPCA). Dr. Snyder was invited to participate in a nutrient workshop at their mid-year meeting. He advocated greater adoption and implementation of 4R Nutrient Stewardship for agricultural nonpoint sources (i.e. farms and fields) as a means to address nutrient pollution challenges, as opposed to establishing untenable strict numeric nutrient criteria and standards for streams and rivers, especially in agricultural watersheds. Many in ASIWPCA may prefer practical nutrient management approaches as opposed to strict numeric nutrient criteria for surface water resources



Dr. Cliff Snyder, N Program Director, examines rice crop N nutrition in California during a field visit.

and Total Maximum Daily Load determinations and enforcement, which are being pushed strongly by the U.S. Environmental Protection Agency in flexing its authority under the U.S. Clean Water Act.

- Numeric Nutrient Criteria for Waters. At the 26th Regional Phosphate Conference in Florida, Dr. Snyder delivered an invited presentation on the status of numeric nutrient (N and P) criteria for waters (lakes, streams, rivers) in Florida, in which he commented on implications for nutrient management in Florida and the rest of the U.S. This situation in Florida is setting a national precedent for other states, which have been encouraged since at least 1999 to develop nutrient criteria for state waters by 2004. While at the conference, Dr. Snyder along with Dr. Fixen, met with state industry leaders to discuss 4R Nutrient Stewardship and nutrient management in view of the strict nutrient criteria for waters in Florida.

Greenhouse Gas Emission reduction

saw intense activity again in 2011.

Among the activities were:

- Nitrous Oxide from Agricultural Sources: Potential Role in Greenhouse Gas Emission Reduction and Ozone Recovery Report. This U.S. Congressional Research Service public report lacked comprehensive consideration

of the published literature beyond strict N rate reductions. Dr. Snyder submitted a detailed letter to the Congressional Science Service to call attention to the scientific knowledge indicating that policy action deliberations must go beyond fertilizer N rate reduction and include consideration of the other three Rs: right source, time, and place.

- Protocols to Mitigate Agricultural Greenhouse Gas Emissions. Dr. Snyder accepted an invitation from climate change scientists at the U.S. Nicholas Institute of Duke University to join a Scientific Advisory Committee that will provide expert input to the development of agricultural greenhouse gas (GHG) mitigation protocols for the Climate Action Reserve (CAR), which is a U.S. offsets program that services the voluntary carbon market and has protocols approved under California's developing regulatory cap and trade system. Dr. Snyder has helped in leading the committee to agree that negative impacts on crop yield should be avoided and that CAR should consider whether and how to take into account increases in GHG intensity (i.e., GHG emissions per unit crop yield).
- Meta-Analysis of 4R Nitrous Oxide Emissions in USDA-CIG Project with TFI. IPNI is providing technical support

to a USDA Natural Resources Conservation Service Conservation Innovation Grant (CIG) project led by TFI and coordinated with others interested in nitrous oxide emission reductions from crop agriculture. The project will assemble published research data on nitrous oxide emissions from corn-soybean cropping systems across the U.S. for a meta-analysis along the lines of the 4Rs.

- USDA Nitrous Oxide Report as Part of Larger National Climate Assessment Report. Dr. Snyder was invited by leaders of the USDA Agricultural Research Service, to contribute as a co-author on a report being prepared as part of the next U.S. National Climate Assessment. IPNI's final NuGIS model was critically important in enabling Dr. Snyder to contribute scientific data and images/maps on the U.S. N balances.

General issues associated with sustainability were also addressed through our N program. Dr. Snyder represents IPNI with the Keystone Field to Market Sustainability Alliance whose recent major activity is development of the Fieldprint 2.0 Calculator which includes estimation of the carbon footprint associated

with typical farm field operations and inputs as well as other sustainability indicators.

He was assertive in getting 4R Nutrient Stewardship language and key science references included in this process. Dr. Snyder and Dr. Fixen also interacted with leaders in the Sustainability Consortium in 2011, meeting with Dr. Marty Matlock of the University of Arkansas, and communicating with industry representatives of Consortium members. The meeting with Dr. Matlock provided an opportunity to expose him to IPNI's NuGIS report, to discuss IPNI's nutrient management interests, perspectives on 4R Nutrient Stewardship, and to foster opportunities for continued communications. The future association between IPNI and the Consortium is under consideration.

Global Maize Project

The Global Maize project is evaluating ecological intensification (EI) as a management approach for increasing corn yields at a pace faster than seen historically. Several locations in the experiment are showing that EI increases yield, N use efficiency, or both when compared to current farmer practice. Most importantly, the major outcome of this project is creating teams of researchers

throughout the world who are actively thinking about what management practices constitute EI for specific environments.

Another major outcome is a peer-reviewed article summarizing the project's background, methods, results, and conclusions. Many sites within the Global Maize project compare the agronomic efficiency of N in EI and farmer practice treatments to better understand possible environmental implications of both systems. The major outcome expected is a statistical analysis comparing these efficiencies between both management systems across all sites and years in the project. This analysis is planned for the peer-reviewed paper mentioned above for this project.

The global maize project is also working to produce internal standards for collecting, recording, and storing data that mesh with the efforts being conducted at Purdue University, mentioned above. The major outcomes are: 1) the establishment of a network of Technical Leads (scientists) who work with IPNI to develop and determine adherence to such standards, and 2) the standards themselves. ■



Asia and Africa Group

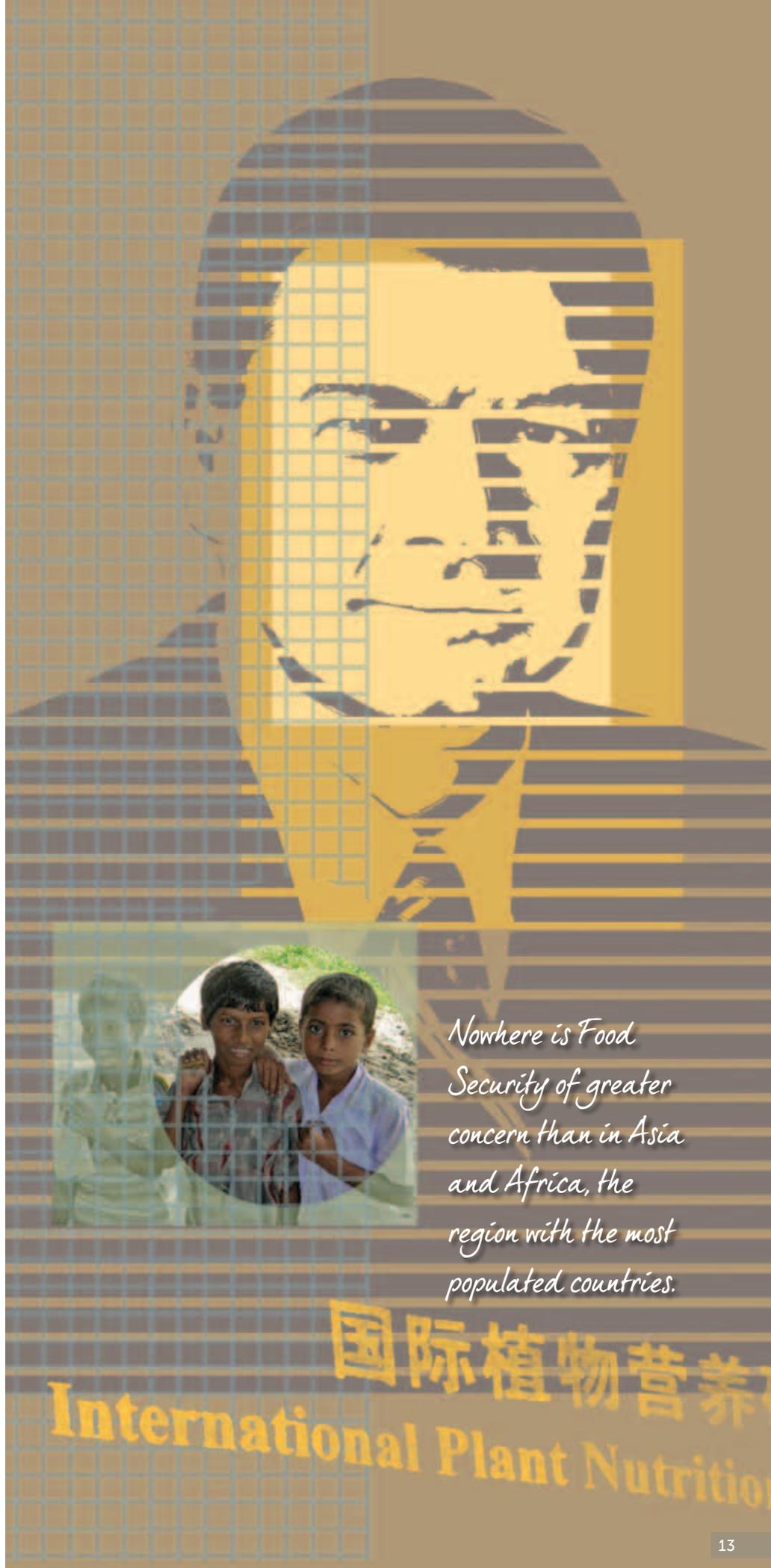
Dr. Adrian M. Johnston

Vice President,
Asia and Africa Group

Communicating Nutrient Stewardship

Each year when we start to plan our annual report we think about what we have been busy with over the previous 12 months, and how to share these activities and accomplishments with supporting members of IPNI. In 2011 there is little doubt that *Communicating Nutrient Stewardship* occupied a major component of our efforts. While communication forms a major part of what we do in IPNI, the effort dedicated to the 4R concept has brought a new level of interest and enthusiasm to all staff, and many of our regional contacts. The ability of our staff to link their message to the international effort by the fertilizer industry around the 4R concept is important support. In fact, many of the results from research and demonstration efforts carried out in the recent years have found an important ally in our effort for communication with the fertilizer industry and general public. So while what we as IPNI staff do has changed little, how we are sharing our information has changed.

The issue of global population was a highlight in 2011, with the world's focus being directed toward the milestones of hitting the 7 billion mark, having over 50% of global citizens now living in cities for the first time ever, and the growing concern that we are rapidly moving toward a global population of 9 billion by 2050. Of course, the most significant part of this news is the rapid rate at which the global population increases now, and whether agricultural production can actually keep up to the growing food demand. So *Food Security* certainly has been an issue of commentary and discussion within the research community. Nowhere is this of greater concern than in Asia and Africa, the region with the most populated countries, and in the case of Africa the region with the highest rate of future projected population increase. When we



Nowhere is Food Security of greater concern than in Asia and Africa, the region with the most populated countries.

国际植物营养
International Plant Nutrition

combine this with the ever increasing middle class population in Asia placing an almost unbelievable demand on feed grain supplies for poultry and pork production, it is fair to say we are well on our way to increasing food and feed grain prices in the foreseeable future. This is a positive impact for smallholder farmers in Asia where a crop like maize (corn) continues to be in high demand and is capturing high prices.

I am also very happy to report that IPNI staff in Asia and Africa have made great strides in our effort to build on our collaborative efforts with the international agriculture centers, the national agriculture research and extension system, and the agriculture industry in 2011. Growing costs of operating are putting an ever increasing strain on our budgets, leading many staff to build partnerships which involve more than a sharing of expertise. Earlier in 2011 IPNI announced that we have done an excellent job in using leverage to expand the impact of our research and development support funds. What we have learned is that a move to a more research focused market development program has caught the attention of many of these potential partner organizations, especially given our strong expertise in leading plant nutrient program activities. While of great benefit to our programs, these

partnerships also bring focus on the issue of how few plant nutrition research organizations are currently working in all parts of the world. The continued focus of IPNI staff on new and innovative tools to deliver plant nutrition information to researchers and farm advisors has the potential to support continued R&D efforts into the future.

China

Production results in China continue to indicate that the country is continuing to increase their food grain supply. While there are no concerns being publicized with regards to food security issues, there is an ongoing effort to improve production in all areas of the country. IPNI staff continue to work with their cooperators in all provinces of China, at national and provincial levels, with both agriculture academies and universities involved. In 2011, IPNI staff in China shared the results of their research and development projects. Like all projects we are involved in, ensuring that the results, or “message”, gets shared with potential users continues to be a major role for our staff. It also involves the process of combining the message from new research with existing information, building on the scientific knowledge that will ultimately support responsible use of fertilizer nutrients. IPNI China

Dr. Fang Chen, China Southeast Deputy Director, visiting an IPNI China Program supported field experiment of rice-vegetable rotation in Fujian province.



staff are communicating these results in our hard copy and web-based publications at the regional level, as well as using regional newsletters, posters, brochures, and mass media such as newspaper, radio, and television. In fact, using a number of these communication methods to ensure the message reaches a wide range of clients remains the ultimate goal.

Dr. Shutian Li, China Northwest Deputy Director (center), directs attention to a balanced fertilized apple in Fengxiang. Dr. Johnston also observes (far left).



In Northwest (NW) China, Deputy Director **Dr. Shutian LI** has been working with cooperating institutions to evaluate the impact of appropriate nutrient use under water-limiting production conditions. China has set high production targets for these semiarid regions of the NW part of the country, with the emphasis being on efficient irrigation methods that optimize production with a minimum of water. Moving from the traditional flood irrigation systems to sprinklers or drip irrigation is a high priority in many regions of NW China. While the findings of research indicate that total water use is often similar between the flood and sprinkler irrigation systems, increased yields with sprinkler irrigation results in a large increase in water use efficiency. When combined with balanced nutrient application, nutrient recovery in the crop was also

improved with sprinkler irrigation. However, the savings in water came with the use of drip irrigation. Work with potato in Inner Mongolia found that drip irrigation could save 25–30% of the traditional water used in flood irrigation, and also achieve similar harvest yields with 50% less N fertilizer. This change in water and nutrient use efficiency clearly indicates that drip irrigation can minimize water and nutrient losses, while maintaining or increasing crop yields. Dr. Li was able to work with his cooperators in NW China to publish a number of these findings in a fertilizer BMP guide, with emphasis on the 4R Nutrient Stewardship concept, for potato production in Inner Mongolia. They also released a number of articles into the Chinese scientific press, as well as developing an excellent *Better Crops* article.

In NW China, Dr. Li reported that returning 50% of the crop residue along with N and P treatment over an 18 year period provided the same crop response as N, P, and K fertilizer treatment. In Southwest (SW) China, Deputy Director **Dr. Shihua TU** reported that wheat straw return in a rice-wheat/rapeseed rotation

resulted in improved grain/seed yields of all crops over fertilizer application alone. The K in straw can supplement fertilizer K to optimize crop yields on alluvial paddy soils, which are deficient in K. In Southeast (SE) China, Deputy Director **Dr. Fang CHEN** has reported that in a rice-rice rotation, highest grain yields came from the treatment where NPK was applied with rice straw returned. This was followed by NPK alone, and then by NP plus rice straw. These SE China results show that the K in straw alone is often insufficient to optimize rice grain yields, especially in this K deficient region. While all of these results are often not statistically significant, it does indicate that K fertilizer requirements are likely to be impacted by straw return activities in China, a reflection of the positive effect of more nutrient recycling within fields. Mechanization is a major component of China moving forward with less labor in agriculture, and also supports the return of crop residues to farm fields. The results of the long-term IPNI crop residue projects have been reported at a number of scientific meetings, and in the scientific journals in China.



Dr. Ping He, China Northcentral Deputy Director, during a spring maize visit to Ecological Intensification in Jilin.

IPNI China staff have also been working with a number of Chinese government sponsored projects. In collaboration with our provincial cooperators, this provides a great opportunity for sharing results and recommendations with other scientists and leaders throughout China. Northcentral Deputy Director **Dr. Ping HE** was active in 2011 completing a Chinese Government sponsored project focused on efficient use of fertilizers in the country. The grant, entitled “Fertilizer saving and efficiency improvement in sustainable farmland”, received high recognition from the Ministry of Science and Technology (MOST). The project was initiated in 2007 in collaboration with other staff from cooperating institutions. The research covered the main grain and vegetable production areas, characterized by overuse and imbalanced use of fertilizer inputs. The study provided theoretical and technical support for reducing fertilizer input by 20% to 30% in intensive cultivation areas. This was a very large project and the recent count is that 413 scientific papers, including 167 peer-reviewed international journal papers, have been accepted or published from these studies. In addition, a book on fertilizer saving and efficiency improvement in sustainable



Dr. Shihua Tu, China Southwest Deputy Director (third from left), visits a winter melon field trial. He is standing with IPNI collaborators from Hainan Agricultural Sciences and Agronomists from Chengmai county of Hainan.



Steve Couch (left), IPNI VP Administration, at field visit in Tianjin.

farming systems will be published in 2012. Results from a number of these national program projects have also found their way into *Better Crops* and *Better Crops China*. These efforts by Dr. He did not go unnoticed, as on International Women's Day in 2011 she was one of the "Red-Banner Pacesetter" award winners, China's National Outstanding

Women's Award. This award is the highest honorary title given to women in China, and was presented in Beijing's Great Hall of the People.

After receiving his Norman Borlaug award from IFA in 2010, **Dr. Ji-yun JIN**, Northeast China Director, was active participating in international conferences in 2011. These regional and international events provide a unique opportunity to share some of the results of IPNI research and development projects in China. In October, Dr. Jin participated in the American Society of Agronomy meetings in Texas and presented a paper entitled Fertilizer Use and Sustainable Crop Production in China. In November, IFA called on Dr. Jin to speak on the topic of Magnesium Fertilization: Opportunities in China and Asia at the IFA Crossroads Asia and Pacific meeting in China. The growing interest in micronutrient nutrition and fertilization is ever increasing across Asia. Both of these events involved making presentations to an audience, and also provided excellent background information which was used in *Better Crops China* articles. As Dr. Jin pointed out, "Finding multiple presentation opportunities to share the results of IPNI China work is the key to increasing the understanding of many

of the challenging issues facing Chinese agriculture". In 2011, Dr. Jin received another honor, the Outstanding Researcher Award from the Grain Bumper Harvest Program run by the Government of China. IPNI staff have been very involved in this program over the years and played a major role in helping it achieve the incremental production success it has achieved.

New fertilizer technology is going to play a critical role in future Chinese agriculture. Over the past 3 years, IPNI China staff, led by Dr. Tu, have been involved in evaluating controlled-release urea (CRU) in maize, potato, and rice. While there are a large number of products that are promoted as reducing N losses when used, this North American developed polymer coating already has a solid scientific track record from the U.S. and Canada. Our work in China showed that the product was superior to regular urea when applied to all crops, with 75% of the CRU rate providing equal or higher yields than regular urea. The IPNI China staff also evaluated the use of CRU in a split application treatment, but this was rarely better than the basal dressing at planting, reflecting the high residual N common in most intensively cropped soils. This CRU

Dr. Ji-yun Jin, Director, China Program and Northeast Region, was being interviewed by the Guangdong TV station while attending a banana field day.



product has now been licensed for use in China and is being distributed in fertilizer blends. Several scientific papers and conference presentations have been made reporting on this research work, and the response both from farmers and their extension advisors indicates the Chinese farmer is ready and interested in these new technologies.

Work with the *Nutrient Expert™* decision support system for maize and wheat has also been moving forward in China. Dr. He reports "Based on yield response and agronomic efficiency data collected using this tool, the *Nutrient Expert™* is rapidly being considered as an important new fertilizer recommendation method in high intensity wheat and maize cropping systems". While China has done a great job in building and expanding the soil testing network across the country, timeliness appears to be a major challenge for farmers, especially when growing multiple crops in one year. With over one hundred field trials being conducted annually to evaluate the new fertilizer recommendation technology, the interest amongst extension workers and industry agronomists is rapidly growing. While several aspects of the project have been published in the scientific press, presentations at regional and national conferences in China have just started. Feature articles in *Better Crops* and other national and international scientific journals are expected in 2012.

Communicating with the global audience is often something IPNI staff are moved to do, especially when they see errors being put forward in the scientific and popular press. In August of 2011, Dr. Chen and associates drafted a letter in response to an article in the international journal *Nature*. The article in concern, entitled "China's grain relies on foreign fertilizer", argued that China did not require foreign fertilizer imports to produce enough food, or maintain food security in the country. In their letter, Dr. Chen presented the facts showing that in reality China's current food production is highly dependent on foreign fertilizer imports, citing the large increases in production which have come from balancing fertilizer N and P use with K



Dr. Kaushik Majumdar, Director, South Asia, North and West (far right), in India maize field.

in all regions of the country. This letter received global coverage and helped to address some of the misconceptions advanced in the article.

Continued support of the IPNI China Program by Canpotex has maintained a very active communication program with government officials, extension workers, and farmers throughout the country. In 2011, Dr. Jin reports the staff coordinated 128 field research trials and 118 field demonstrations specifically focused on the appropriate use of K in balanced fertilization programs. This was complemented with 80 field visits with local government officials, those people who significantly influence the research funding opportunities for most of our cooperators in the provinces of China. In fact, it is interesting to note that while IPNI was a major funder for many of our cooperators 10 years ago, we now constitute only a small fraction of the funds received by most of these active research programs today. This is great news, and supports the "planting the idea seed" approach which has been used in China over the years of the IPNI program. There were 24 harvest field days held in 2011 where the staff work to gather not only local farmers and extension workers, but also industry

agronomists are involved to support the linkage between the results of research and development and the role of the agriculture supply sector. A total of 11 TV and radio programs were recorded for the agricultural networks in China in 2011, a very effective means of reaching a large number of Chinese farmers. Finally, the China program staff translated the IPNI *Nutrient Source Specifics* publication series in 2011. This series of short fact sheets describes all of the fertilizer nutrient sources, and was originally developed in English by IPNI North America staff member Dr. Rob Mikkelsen.

Dr. Jin noted that the IPNI program is moving forward with support from several member companies. Says Dr. Jin "We are very happy to report that new projects have been initiated with BPC in northern China in 2012 with the leadership of Dr. Li, evaluating a number of high value crops to K application. In addition, we continue our cooperation with Agrium in evaluating their new controlled release N fertilizers in China".

South Asia

In late 2010, **Dr. Kaushik Majumdar**, Director of the South Asia program

received an inquiry from a research scientist to determine if IPNI might be interested in publishing a series of photographs that had been accumulated on cereal crop plant nutrient deficiencies. This resulted in the printing of *A Guide to Identifying and Managing Nutrient Deficiencies in Cereal Crops*, published by IPNI in cooperation with the International Maize and Wheat research center in Mexico (CIMMYT). The guide covers six crops, including maize, rice, wheat, sorghum, pearl millet, and barley. The book was developed to serve as a field guide to help with the identification of major nutrient deficiency symptoms, understanding the causes of such deficiencies and provide some suitable remedial measures. The publication features a series of photographs collected by Dr. Prakash Kumar and Dr. M.K. Sharma of Department of Agriculture, Govt. of Rajasthan. The publication was picked up by the Fertiliser Association of India, who has run a series of articles in their monthly journal, the *Indian Journal of Fertilisers*, highlighting each of the six crops individually. In addition

to the high demand the staff are receiving for the publication in India, it is also being adapted for use in Africa as well. This publication illustrates an important aspect of the network IPNI has in many parts of the world, with a single effort in one region resulting in its subsequent translation and use in multiple other regions and by our industry partners.

IPNI continues its work in India to help change the state-based fertilizer recommendations being made. Experience has shown that in almost all instances these state-based recommendations are seriously flawed with respect to either under-estimating, or ignoring, K use in the recommendation. **Dr. T. Satyanarayana**, Deputy Director for the Southern Region of the South Asia Program, hosted a workshop to review K fertilizer recommendations in the state of Orissa. The meeting featured a number of speakers, all of which highlighted the deficiency in the current recommendation system when it comes to K use. Both yield and crop quality improvements could be significantly achieved with a change in fertilizer recommen-

dations. Similar workshops have been held in several states of India in the past, and in most cases the fertilizer recommendations have been revised to better reflect the crop needs for all nutrients. We anticipate that the follow-up discussions will be completed in 2012 in Orissa, leading to a similar revision and rebalancing of recommendations in that state.

Managing nutrients on horticulture crops has always brought with it a problem of over-application, largely a result of the high value of many of these crops. Work initiated in 2010 has resulted in the Integrated Nutrient Management guide, developed by IPNI and the International Horticulture Innovation and Training Centre in Jaipur, Rajasthan. The project, led by **Dr. Harmandeep Singh Khurana**, former Deputy Director in Western India, saw the development of a guide which provided detailed instruction on nutrient sources, fertilizer application rates, mixing instructions for solution application, and related management aspects for horticulture crops. The issue of calculating fertilizer rates

For Dr. T. Satyanarayana, South Asia Deputy Director (far left), developing videos and producing DVDs has been a means of educating farmers, extension workers, and agronomists in the region and will add to the tool box for disseminating information on right use of plant nutrients. Looking at the growing importance of transgenic cotton in India, IPNI South Asia Program has taken an initiative for developing a new cotton video on the importance of right nutrient management on yield and fiber quality.





Dr. Shamie Zingore, Director, Africa Program.

is a highlight, bringing the guide users attention to realistic rates of nutrient application for achieving both high yield and desirable quality of horticulture crops. The guide is used as part of the training programs at the Horticulture Centre in Jaipur, and is featured on the IPNI website for South Asia.

The efforts of IPNI to develop the *Nutrient Expert*TM decision support system tool for both maize and wheat in South Asia is showing great progress. This activity is linked to the Cereal Systems Initiative for South Asia (CSISA) program and being run in India, Nepal, Bangladesh, and to a limited extent Pakistan. Currently, we are nearing the end of a comprehensive field trial program which gathered information used to verify the accuracy of the *Nutrient Expert*TM tool in making appropriate fertilizer recommendations. The results indicate that while N and P rates change little from those currently recommended by the state governments, a higher K recommendation is being made and considered the primary reason for the higher yields being obtained. As we are well aware from past experiences, many regions of South Asia suffer from a K deficiency, and responses can be significant. Both Dr. Majumdar and Dr. Satyanarayana are working throughout the

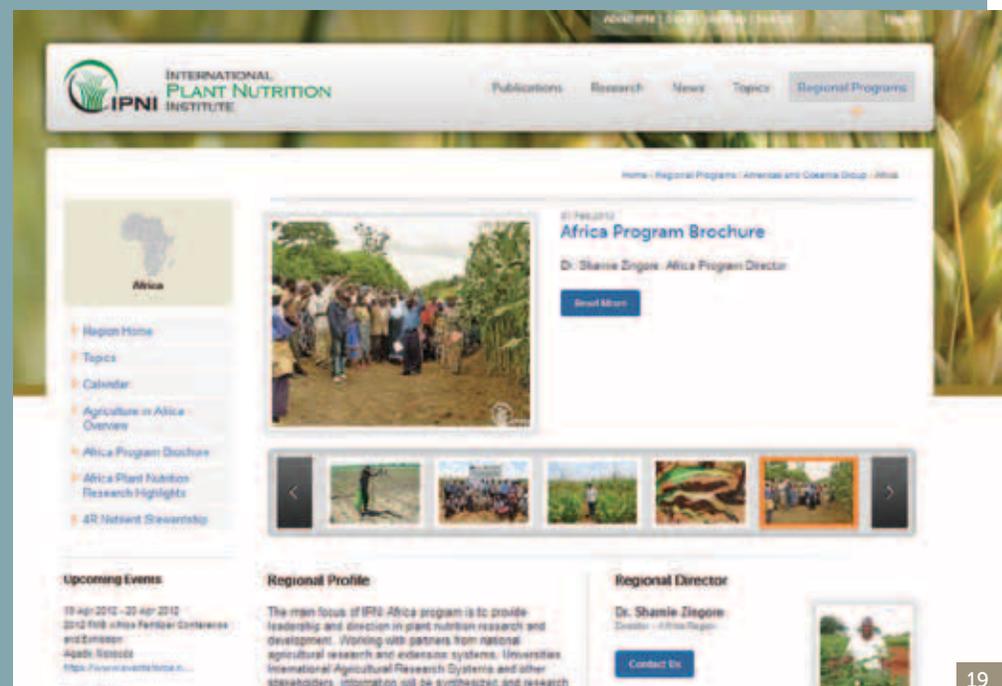
countries of the region to gather necessary field trial data, verify model outputs, and build relationships with both industry and government extension staff to evaluate the model with their farmers. The *Nutrient Expert*TM tool has provided our staff with numerous opportunities to make presentations at Universities and research institutes throughout India, Bangladesh, and Nepal, and to summarize the project results in scientific and trade publications.

While as scientists we often put a heavy emphasis on written communication, use of radio is of critical importance in reaching large numbers of clients in Asia. For the last few years, South Asia Deputy Director Dr. Satyanarayana has been working with Coromandel Fertilisers of Hyderabad and Canpotex to deliver timely messages on nutrient management to farmers via the All India Radio network. In 2011, the topic of Rational Use of Plant Nutrients was broadcast, with the short radio messages focused on emphasizing the importance of balanced fertilizer application and the merits of integrated nutrient management. These broadcasts attract large numbers of positive comments for our staff and the sponsors, and support the ongoing effort to build education amongst the farms.

Africa

The IPNI program in Africa is becoming well established with a number of research projects, interactions with the fertilizer industry, and collaborative activities. In particular, we are happy to report great progress in the Africa Program as it relates to communication activities with researchers, extension advisers and farm groups. Director **Dr. Shamie Zingore** has been busy working on a project supported by the Bill and Melinda Gates Foundation (BMGF) with the expressed purpose

A current screen capture from Dr. Zingore's IPNI website for the Africa Program.



of developing publications and videos for use in training agriculture project staff in Africa. To date, Dr. Zingore has been working on a nutrient deficiency handbook for cereal crops. In addition, field visits and images are being collected for a similar guide on tree crops, such as coffee, cocoa, and oil palm. These nutrient deficiency guides play an important role in building both an understanding and ability to respond when deficiency symptoms are found in the field. The nutrient deficiency guide for cereal crops, first developed by the South Asia Program of IPNI, has seen strong positive feedback from the agriculture industry and extension staff.

Dr. Zingore has also been working with Africa Soil Health consortium to develop a handbook on Integrated Soil Fertility Management (ISFM) for sub-Saharan Africa. The ISFM concept has developed over a number of years, and focuses on the integrated use of fertilizers with legume crops, crop residues, and livestock manure in supporting improved productivity on African farms. Manure use, as in most regions of the world, has great potential to improve degraded soils in sub-Saharan Africa. The problem is the supply and distribution of manure for improving soil quality and fertility.

Only a small portion of farmers in sub-Saharan Africa have cattle, and they are the ones who can benefit from a supply of manure. In reality, this leaves grain legumes, crop residues, and fertilizers as the major ISFM tools for most farmers in the region.

Supporting agriculture workers engaged in managing field research and demonstration projects is also a major priority for Dr. Zingore. Some of the basic skills required to set out and manage these field activities is lacking in many regions of Africa. Working with the Africa Soil Information Service (AfSIS), he helped to co-author the *Field Guide for Diagnostic Trials*. While this type of publication may seem redundant in many regions of the world, having some clear and concise guidelines, or a “how to guide”, is really critical to achieving success with field projects in many parts of Africa. While many program staff have basic agricultural education, they lack the background experience of setting out and managing a field trial to effectively collect useful information. As part of the IPNI Africa Program, we see the activities related to building “human capacity” in the area of field research as a critical component of our communications plan in moving the nutrients industry forward.

Poor access to up-to-date scientific information on plant nutrition by students and researchers in Africa is a challenge holding back research progress in the region. A bimonthly newsletter, *Africa Plant Nutrition Research Highlights*, were initiated in 2011 publishes highlights from key research articles related to plant nutrition research in Africa to promote sharing and exchange of information on best nutrient management and sustainable crop production intensification in the region.

Success was achieved in 2011 with the establishment of new research projects in Kenya and Zimbabwe evaluating the response of maize to nutrient management. This complements the on-going IPNI project in Mozambique, started prior to the initiation of our regional program in Africa. All of these projects are focused on the assessment of N, P, and K responses, understanding the spatial variation caused by both management and soil types, and supporting the verification of the *Nutrient Expert™* for maize decision support system. Dr. Zingore reports that “results to date clearly indicate that attainable yield in many of the trial locations are considerably higher than previously estimated, with soil variability and management





Dr. Thomas Oberthür, Southeast Asia Director (far left), and senior oil palm consultant Chris Donough (front row, middle), with the team of the bunch analyses laboratory of the plantation Sungai Rangit (SR) in Kalimantan, Indonesia. The SR plantation is a partner in IPNI's Best Management Practices project for oil palm plantations.

history significantly influencing the fertilizer responses". The first version of a *Nutrient Expert™* for maize has been developed for sub-Saharan Africa, which will allow field verification and fine-tuning before being publically released.

Southeast Asia

Southeast Asia remains a region of strong growth, due to both demand for exports and domestic consumption continuing to grow. Agricultural growth also continues, and IPNI sees current and future expansion in this sector coming through ecological intensification, rather than area expansion. While the region does have substantial tracts of undeveloped lands, a concerted effort to conserve forests and biodiversity is shifting everyone's focus to production intensification. The region has two dramatically contrasting key farming systems: commercial plantations and smallholders, both of which differ in the way they respond to agricultural development. Some smallholders are still practicing subsistence farming. Finally, similar to other regions in Asia, the growing challenge of a shrinking agriculture labor supply will force the

sector to innovate. IPNI Southeast Asia Director **Dr. Thomas Oberthür** sees many of these issues as strong drivers for intensification of key cropping systems, supporting the targeted use of fertilizers to improve both yields and economic returns to growers.

The oil palm sector, especially plantation operations, remains a major focus for the Southeast Asia Program of IPNI. In 2011, Dr. Oberthür worked with IPNI Southeast Asia Program oil palm consultant Mr. Chris Donough to complete the oil palm video series. This video production was developed over a number of years as a means of highlighting the results of the IPNI BMPs research program in the region. This field research, which was carried out in mature plantations, clearly showed that changing agronomic and nutrient management practices could raise oil palm yields by up to 30%. However, these improvements come through the implementation of not just nutrient management practices, but rather combining fertilizer management with on-the-ground best practices such as short harvesting rounds, precise frond placement, and integrated pest management. The video

details how to best implement the BMPs in a plantation. Along with the distribution of the video to current plantation cooperators, the information will be used in the oil palm training program to be delivered in the region in 2012 and beyond.

Once again in 2011, staff from the IPNI Southeast Asia office completed another addition of the Canpotex sponsored *Planter's Diary*. This annual publication is eagerly anticipated each year by our partners working in the fields, plantations, government offices, and fertilizer companies. Highlighting the results of completed research, ongoing projects and agricultural production tips, this diary ends up on the desks and in the backpacks of many working in the industry. Demand for this publication seems to grow each year as more IPNI and Canpotex partners learn of its availability and useful information.

The Southeast Asia office of IPNI is headquarters for the advancement of the *Nutrient Expert™* decision support system activities currently being carried out in South Asia, China, and Africa. Under the direction of IPNI

Southeast Asia Program agronomist **Dr. Mirasol Pampolino**, the original *Nutrient Expert™* tool, developed for tropical maize in Southeast Asia, is now being adapted to irrigated maize and wheat across South Asia and China, and dryland maize in Africa. To date, the field trials conducted in all these regions to evaluate this decision support system indicate that the tool is capable of matching, or significantly improving on, otherwise available fertilizer recommendations. The results indicate that the tool is capable of increasing yields of wheat and maize in India through improved nutrient balance, maintaining the current high yields in China for both crops with a significant reduction in total fertilizer use, and building nutrient recommendations based on nutrient balance and soil moisture supplies with rainfed maize in Africa. Scientific publications, users manuals, and in a few cases software, have been developed as part of the research effort. IPNI programs in China and South Asia are

currently completing the field trial stage of this program, with plans in 2012 to start working with agronomists from industry and government extension to trial the software with farmers. Ultimately, the goal is to determine how effective and useful the *Nutrient Expert™* software will be in serving the needs of the agronomists working with farmers, and finally the farmer in building yields, and/or profits from fertilizer use.

Moving forward with the data and information gathered from working with *Nutrient Expert™* in Southeast Asia, Dr. Oberthür proposed the development of the Nutrient Intelligence (NI) approach. Nutrient Intelligence is an analytical approach to using not only agronomic research data, but also environmental, input, and commodity market information and labor availability to improve our understanding of fertilizer market development opportunities in a region. While support for the NI concept with annual food crops has yet to be secured, partners were found to initiate

work on a similar concept in oil palm, under the project title Plantation Intelligence (PI). Building on IPNI Southeast Asia Program's leadership position as a provider of industry-standard production advice, the goal of PI is to interpret routinely collected plantation information to develop key performance indicators allowing managers to benchmark and evaluate the relative production and profitability performance of blocks, estates, and plantations within a region. This type of information is critical to the process of systematically deploying BMPs to intensify the production of palm oil, and in doing so avoiding unnecessary expansion into forested areas. Specific information on production performance can be made available to individuals in confidence, while regional information will be available to all participating plantations. Ultimately, the PI effort is focused on moving the oil palm activities of IPNI back to the specialization of adviser to the industry on production and intensification practices for this important plantation crop. ■



Eastern Europe/Central Asia and Middle East Group

Dr. Svetlana Ivanova

Vice President, Eastern Europe/
Central Asia and Middle East Group;
Director, Central Russia

EECA Region

2011 was the first year the Eastern Europe and Central Asia (EECA) program fully implemented regional activities with scientific and educational publications, research projects, communications, and education.

Publications

In 2011 the major focus of IPNI activity was the development and publication of printed materials. We continued regular production of the IPNI Newsletter in Russian (which was started in 2010), translation into Russian and adaptation to EECA conditions of IPNI educational booklets to assist in the promotion of integrated crop management and proper fertilizer use in the region.

The IPNI Newsletter in Russian has been issued every quarter of 2011 in the format of a practical journal containing 20 to 24 pages. This highly successful newsletter was possible only due to teamwork of our people working in the Moscow office and the creative contribution from everyone. Issues have focused on topics ranging from spatial and temporal variability in agricultural systems to plant nutrient management and modern approaches to improve fertilizer use efficiency to K fertilizer efficiency in the leading agricultural countries of the EECA region. In total, 17 scientific articles have been published in the four editions in 2011 and the list of subscribers has increased to more than 1100 correspondents from Russia, Ukraine, Kazakhstan, Poland, and Bulgaria. Our audience includes agronomy and marketing staff of the leading fertilizer producing companies, fertilizer distributors, agronomists and management of large industrial farms, researchers, and regional farmers' professional organizations.



The list of subscribers to the Russian IPNI Newsletter has increased to more than 1100 correspondents from Russia, Ukraine, Kazakhstan, Poland, and Bulgaria.

The booklet *Be Your Own Maize Doctor* is another result of teamwork by the IPNI staff in Moscow—translation and adaptation by Dr. Vladimir Nosov, editorial work by Dr. Svetlana Ivanova, and layout by Ms. Alexandra Erofeeva. The booklet was further revised by Dr. Bagrintzeva, who is the local leading expert from the Maize Research Institute.

The Russian version of *Be Your Own Soybean Doctor* was written by: Drs. Nosov and Ivanova from IPNI; Dr. V.I. Zaostrovnykh and Mrs. M.S. Rakina from the Kemerovo State Agricultural Institute; and Dr. L.K. Dubovitskaya, Dr. N.V. Mashchenko, and Mr. A.N. Dubrovin from the Soybean Research Institute. Deficiency symptoms of nutrients have been adapted from the English version while a chapter on soybean diseases includes brief descriptions of the diseases common for the EECA region. All descriptions of nutrient deficiencies, soybean diseases, and insect pests are accompanied with quality images from the media collection of IPNI and other organizations.

Projects

In 2011, the first regional research project was implemented in Ukraine and on field trials for global IPNI projects started in Russia.

Dr. Ivanova has established a research project on Evaluation of the K status of Ukrainian soils on the basis of modern soil diagnostic techniques and development recommendations for the rational and efficient application of K fertilizers in cooperation with the Ukrainian National Scientific Center “Institute for Soil Science and Agrochemistry Research named after O. N. Sokolovsky”. Project activities in 2011 included field experiments on K fertilization for maize and sugarbeet, and creation of a research database to develop long-term prognosis of the K status of arable soils in Ukraine. According to the prognosis developed, the average weighted content of plant-available K in most Ukrainian soils will remain balanced almost at the natural level corresponding to the average K supply up to 2020. The results of a field experiment with maize

and sugar beet showed a high efficiency and economic expediency of applying K fertilizers to Chernozems even with high content of plant-available K. The comparison of the values for the content of plant available K obtained by different methods showed that the extraction with 0.5 M CH₃COOH (acetic acid) recommended as a routine soil K test for non-calcareous Chernozems not only in Ukraine, but also in Russia and Kazakhstan, overestimated the K supply of clayey soils widespread in the EECA program region.

Dr. Vladimir Nosov, Director, Southern and Eastern Russia Program, has started the *Global Maize project* in Southern Russia in cooperation with the Southern Federal University (Rostov-on-Don) and the State Variety Testing Unit “Tselinskiy” (N. Tselina, Rostov Oblast). A maize-soybean crop rotation is being studied. Soil at the experimental location has a high content of plant K extracted by a routine soil test and also a high content of exchangeable K. However, K fertilizer application increased maize yield by 7% compared to NP-treatment. The *Hybrid Maize* model was used to simulate potential maize yield and the actual yield obtained in 2011 was very close to the yield potential simulated by the model.

Field trials with nutrient omission plots in spring wheat were conducted in Eastern Russia by Dr. Nosov in cooperation with the Bashkir State Agrarian University (Ufa) and the Siberian Research Institute of Agriculture (Omsk). The highest yield of spring wheat (3.1-3.5 t/ha) was obtained in treatments with ample application of N, P, and K.

Communications

The EECA regional website in Russian has been developed for the numerous regional Russian speaking audiences from the former Soviet Union countries. The website was designed as a leading resource for information on modern agriculture and proper nutrient management for our focus audiences, helping contribute to regional sustainable agriculture development and proper fertilizer use. The website contains information on global and regional IPNI activity, such as upcoming events,

Dr. Vladimir Nosov, Southern and Eastern Russia Director (left), and Dr. I.F. Khramtsov, Director, SRIA (right) visiting Experimental Agricultural Enterprise “Omskiy”, Omsk District, Omsk Oblast, Russia.





research projects, the catalog of IPNI materials in Russian, reviews of scientific publications on soil science and plant nutrition, summaries of all articles from *Better Crops* since 2010, the collection of IPNI Newsletters in Russian, and general information about IPNI awards. The website also contains presentations and publications on highly relevant topics for the region: 4R Nutrient Stewardship, crop nutrition, effectiveness of mineral fertilizer use, fertilizer economics, agriculture development, no-till and fertilizer use, precision agriculture, and soil test and plant analysis.

The EECA regional website in English has been substantially upgraded and designed to better serve English speaking audiences. It contains general information on agriculture in the EECA region, statistics, a calendar with regional coming events, short descriptions of regional IPNI research projects, a catalogue of IPNI educational materials in Russian, and a collection of regional articles published in *Better Crops with Plant Food*.

As a part of our educational activities Dr. Nosov participated in a large number of regional and international events in

2011. He made presentations at conferences held during the SouthAgro Agri Exhibition in Krasnodar, South Russia. The first event, the V International Conference Russian Grain, was organized by the Russian Grain Union (RGU) in cooperation with JSC August Inc. (major Russian manufacturer of pesticides), Ministry of Agriculture of Russia, and the Regional Government of Krasnodar Krai. Dr. Nosov spoke on "The Benefits of Mineral Fertilizer Application to Winter Wheat in Current Conditions". The audience included regional authorities, heads of leading agrohholdings and agri-enterprises, and grain market analysts. In the second event, the Conference on Innovations in Rice Cropping Targeted to Increase the Effectiveness of Rice Sector organized by the Southern Rice Union (SRU) and Department of Agriculture and Processing Industry (DAPI) of Krasnodar Krai, he delivered a presentation on IPNI: "Research on Mineral Nutrition of Rice". The audience included representatives of district departments of agriculture and heads of leading rice growing agri-enterprises. Krasnodar Krai produces 80% of Russia's rice and harvested a record rice grain

output of 0.94 million metric tons (Mt) with an average yield of 7.0 t/ha (bunker weight) in 2011.

However, inadequate P and K nutrition now limits further increase in rice yields, because unbalanced fertilizer application with large N rates and low P and K rates is a common practice among rice growers. Decreasing content of available P and K in soils from high to medium levels is now widely fixed in rice fields of the region. Dr. Nosov also contributed to a joint poster with Dr. Jensen and Dr. Norton presented at the 13th International Rapeseed Congress (Prague, Czech Republic).

Dr. Ivanova participated in the VIII international annual conference CIS Fertilizers 2011 held in Odessa, Ukraine, presenting on Governmental agricultural support in Russia: effective programs and new projects. The meeting gathered about 150 participants—mostly leading fertilizer producers from EECA region, from industry organizations such as IFA and Fertilize Europe, management of large industrial farms and crop producers' organization (Agrarian Union of Ukraine, Ukrainian Grain Union).



Dr. Nosov (left), Dr. Ivanova (center), and Alexandra Erofeeva (right) distribute publications and represent IPNI during Agri Fair in Moscow.

The conference "Role of Chemistry in Innovative Development of Russia" was held as part of the 16th International Exhibition "Chemistry 2011". The exhibition included about 500 companies from Russia, Germany, France, Switzerland, China, and other countries, organized under Government and private auspices, including the largest fertilizer producing companies. During the conference, Dr. Ivanova delivered a paper and presentation on the scientific principles of fertilizer BMPs.

Dr. Ivanova visited the leading regional agricultural research organizations in the North of Kazakhstan, and introduced IPNI to scientists from the Cereals Research Institute, Kazakh Agro Technical

University, and National Agro Chemical Service. She also visited CIMMYT's center in Kazakhstan to discuss possible regional cooperation between IPNI and CIMMYT. Currently, CIMMYT's activities in Kazakhstan are focused on germplasm improvement, including development and support of the Kazakhstan-Siberia network on spring wheat improvement and the Kazakhstan-Mexico-Canada/USA shuttle breeding program for spring wheat. Additionally, efforts are being made on bio-fortification of wheat, promotion of conservation agriculture for wheat production and crop diversification, and strengthening the national agricultural research system. IPNI is exploring cooperation with CIMMYT in Kazakhstan on a

wheat nutrition project that focuses on fertilization in conservation agriculture.

In North Kazakhstan, Dr. Ivanova delivered a presentation on 4R Nutrient Stewardship at the National Scientific Conference organized by Seifullin Agro Technical University. The conference gathered about 200 participants from the different regions of Kazakhstan, and served to introduce IPNI's global activities, our regional program, IPNI's Newsletter, and publications in Russian to the local scientists and students.

In October of 2011, the VI International Specialized Exhibition of Agricultural Machinery "AgroTech Russia-2011" took place as part of the agro-industrial exhibition "Golden Autumn". "AgroTech

Russia” is one of the largest demonstration grounds for agricultural machinery and equipment in Russia. In 2011, 623 companies and agencies from 29 countries brought the best standards and models of agricultural machinery, seeds, fertilizers, plant protection agents, and other inputs necessary for the agro-industrial complex enterprises of Russia. Modern production techniques for storage and primary processing of crop products were also introduced. Approximately 23,000 people visited the exhibition during four days, with 90% of them being agricultural specialists. This was the first time the EECA office participated with a stand in this exhibition, which allowed IPNI to distribute information about regional activities to a wide audience and gave opportunity to meet personally with agronomists from large industrial farms, farmers, and extension agents, and distribute IPNI educational printed materials in Russian.

Educational Activities for Industry

As a part of our commitment to educational activities, Dr. Ivanova and Dr. Nosov conducted a training course for industry agronomists, analysts, and marketing staff in Minsk, Belarus, in March of 2011. The program of the training highlighted the following items: tools for science-based marketing of fertilizers and nutrient management related services, economics of fertilizer use, and overview of the status of current IPNI activities in the EECA region.

Middle East Region

Farmers, extension agents, and fertilizer company dealers need to be trained and educated on the concept of BMPs and the importance of promoting balanced fertilization to improve productivity and efficiency of farming systems in the Middle East (ME). This region is an arid and semi-arid environment and is suffering from scarcity of water. For years, the land has been cultivated with traditional unbalanced fertilization with respect to P and K as well as micronutrients. This has led to depletion of these nutrients from the soil, which used to have adequate supplies. Moreover, there is a big gap between food supply

and demand in most countries of this region, creating a big challenge for the agriculture sector and calling for adopting the most innovative technologies to enhance crop production. Adopting the fertilizer BMPs can not only enhance crop productivity but also ensure its sustainability.

To meet these challenges, IPNI is conducting two agronomic projects in Syria and Egypt. IPNI activities included implementation of on-research station experiments, on-farm demonstration trials and farmer fields, publication of extension and outreach materials, as well as organizing a training workshop for capacity building and for transferring knowledge and innovative technology to farmers, extension agents, and decision makers. The results of the field experiments conducted by IPNI in Syria and Egypt on wheat and maize in 2011 demonstrate the positive effect of balanced fertilization treatments on yield and yield components and nutrient content compared to both unbalanced fertilization and control treatments. Targeted crops in various locations of Egypt and in Syria have responded positively to balanced fertilization. This also was reflected favorably in restoring soil fertility

level and therefore sustainability of soil productivity.

IPNI is continuing to significantly contribute to transfer innovative technology in fertilizer use and train local staff on BMPs for enhancing balanced farming systems. This was achieved through demonstrating the positive impact of balanced fertilization on the crop and soil productivities and increasing farmer income.

In 2011, IPNI presence in the ME region has been expanded. In October of 2011, **Dr. Munir Rusan**, Consulting Director, Middle East, and Dr. Ivanova have organized in Turkey working meetings with the leading scientists from the main agricultural research institutes and universities including Ege University, West Mediterranean Agricultural Research Institute, Cotton Research Institute, Hazelnut Research Institute, and Cukurova University. Challenges and opportunities to implement the project focused on K fertilization in Turkey have been discussed during the meeting. This productive meeting let us identify the appropriate regions, crops, and local partners, which provided the basis to the project development and its implementation in 2012. ■

Dr. Rusan, Consulting Director, Middle East (right), with farmer from Egypt comparing control vs balanced fertilization.



Communications

*What we as IPNI staff do
has changed little;
how we are sharing our
information has changed.*

This past year has been an exciting time within the IPNI Communications Group, not simply from a personal perspective as I near the completion of one full publication cycle as Editor, but I can also speak as someone with a clear view of the new developments our staff have been involved in, and the direction the Institute is moving. From my desk, it's great to see how our regional programs strive to broaden their reach, and strengthen their connections to the regional audiences they serve directly ... and the global audiences they inform.

Building on Past Success

It is especially exciting to see our newest regional programs establish methods best suited for reporting on their regions and sharing their expertise. In Eastern Europe and Central Asia, our library of Russian language publications is steadily expanding as key publications are selected for translation, and new projects are waiting in the wings. This has also been the first full year our programs in Russia have communicated via their quarterly *Plant Nutrition Newsletter* (Питание растений), which follows the highly successful format of the Spanish (*Informaciones Agronómicas*) and Portuguese (*Informações Agronômicas*) newsletters that have been distributed to subscribers throughout South and Central America, Mexico, and the Caribbean for decades. In late 2011, our newest program in sub-Saharan Africa also initiated its bi-monthly newsletter entitled *Africa Plant Nutrition Highlights*. The series is initially intended to act as a forum for invited researchers to cover summaries of recent issues and developments in nutrient management in Africa. In Southeast Asia, an on-line newsletter provides its readers with timely updates and insights on key

issues pertaining to recent activities of the regional program and selected news on regional developments. From North America, IPNI continues to offer both its quarterly new series *Plant Nutrition Today* and the more in-depth, topical series *IPNI Insights*. I invite you to visit the Publications section of our website and subscribe to any of these informative resources that are only a click away.

New Efforts

The past 12 months has involved a great deal of activity related to the finalizing of some critical projects, but perhaps the most anticipated has been the inaugural release of our new *4R Plant Nutrition*



Gavin Sulewski, IPNI Editor

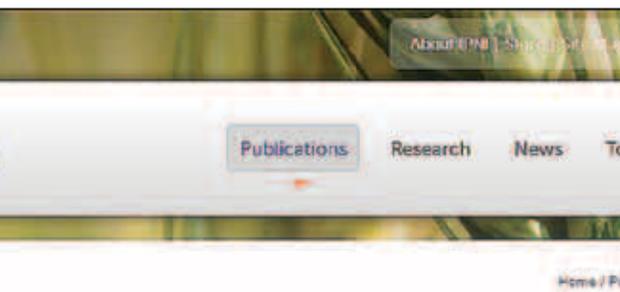


Manual. This manual is designed as a key resource in support of 4R Nutrient Stewardship—the worldwide fertilizer industries’ concerted approach to promoting fertilizer BMPs. The manual provides a comprehensive outline of the scientific principles that support the simply stated, yet often cited, ‘4R’ concept of applying the right source of nutrient, at the right rate, at the right time, and in the right place. IPNI has released this manual as a North American units version and a fully metric unit version. Next, work on translating the manual into Spanish, Portuguese, Chinese, Russian, and other languages can commence. In addition to the manual, IPNI is planning the development of

alternative methods of providing 4R training including an on-line system of delivering 4R learning modules, case studies, and training tools that users can select based on their specific location or need. Other work related to 4R includes the expansion of our popular crop-specific 4R video series *The Right Way to Grow...* which this year will add Rice to the collection.

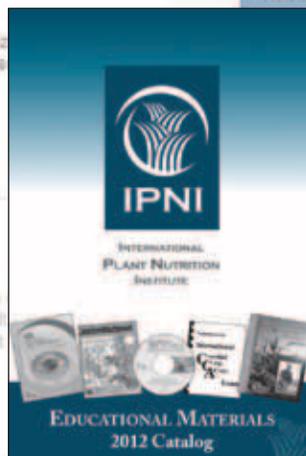
One other new publication that IPNI is pleased to have available in 2012 is the metric version of the manual on *Mathematics and Calculations for Agrono-*

mists and Soil Scientists. This college classroom tested text was originally developed in U.S./Imperial units for a North American audience. The release of a metric version of this teaching resource and desktop reference gives this publication a more global application. Another achievement is our expansion of the *Crop Nutrient Deficiency Image Collection*, which has moved to a flash-drive format due to the large number of high quality images that have been assembled from sources like our annual photo contest and other publications.



Nutrient Source Specifics

For brief information about the production, agricultural use, and chemical properties of common fertilizer Nutrient Source Specifics are one-page fact sheets covering various fertilizers and nutrient sources. Written by IPNI staff, these items are primarily for educational use by a general audience. Consult with a local expert regarding specific recommendations on nutrient use.



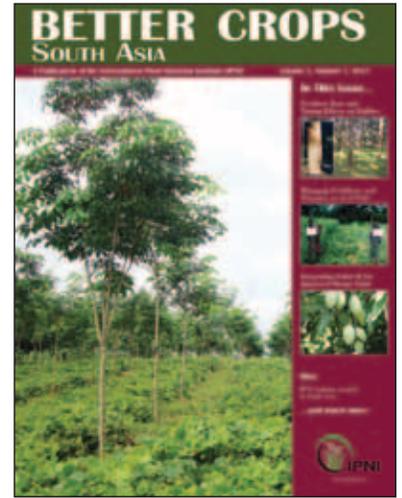
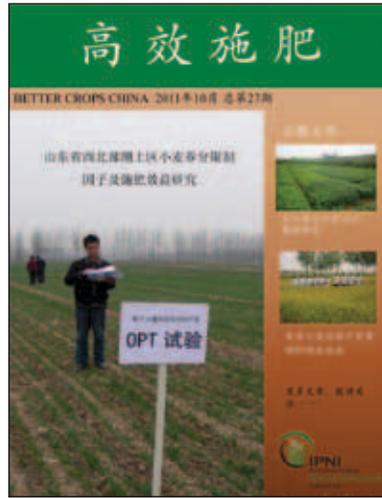
Efforts About to Unfold

A major undertaking over the past year has involved extensive groundwork required to support our effort to renew IPNI's main website at www.ipni.net as well as our series of regional websites. Our goals: provide a fresh face that more clearly represents our activities, products, and services; and take full advantage of the latest in search engine technology and selected social media services. We are eager to release these improvements; some features, like our new Institute-wide index of publications are already in place. However, most will be phased-in throughout the remainder of 2012. Watch for more this summer as we ramp up our web transition and reveal our new on-line presence. Another direction we are just beginning to explore is our ability to provide content and services in the newest digital formats consumed by the omnipresent mobile device. Specialized mobile application services and e-book formats definitely present an interesting opportunity for IPNI as we look for new ways to add to our menu of communications products.



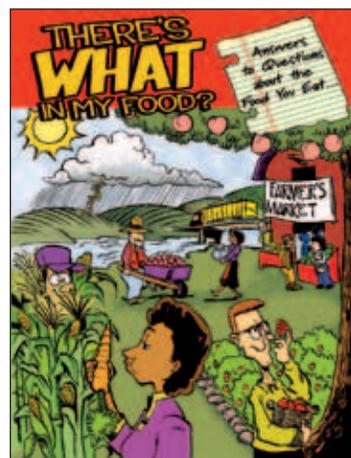
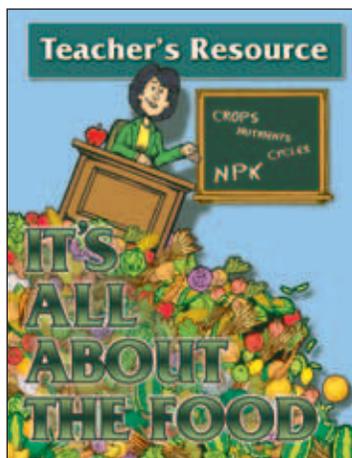
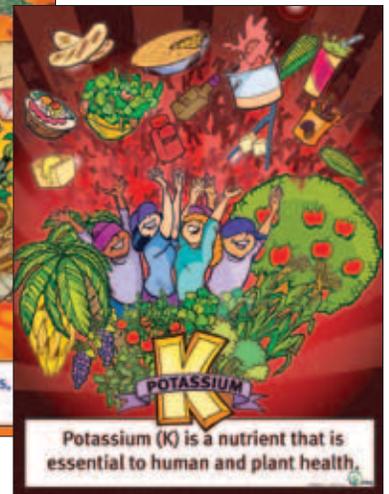
nutrition of wheat, which will highlight the importance of the crop and its nutrition globally, show regional differences in nutrient management strategies between spring and winter wheat regions, and highlight some of the emerging technologies and support systems for managing nutrients in

wheat. As an outlet for the promotion of production-based agricultural research, written with the practitioner in mind, *Better Crops* provides IPNI a platform that continues to be well-positioned to equally serve both the network of agricultural researchers that contributes to each issue as well as our readership. ■



Better Crops with Plant Food

Of course the tradition continues from the heart of our group's effort, *Better Crops with Plant Food*, and its sister publications, *Better Crops China* (in Mandarin) and *Better Crops South Asia*. A single issue of *Better Crops* can often take us from a corn field in the Midwest USA to a smallholder's plot in Africa, to an expansive plantation in the tropics with a flip of a page. The diversity of the stories in this magazine is a reflection of our access to the regions in which we operate, and the researchers we cooperate with. This year look for an issue dedicated to managing the



BETTER CROPS

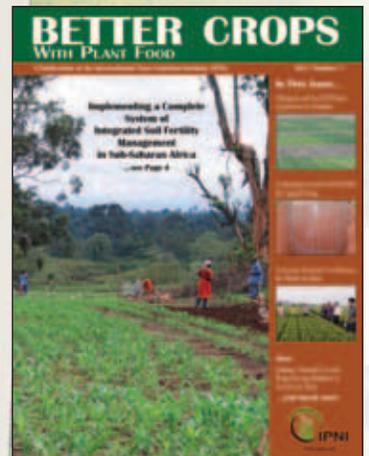
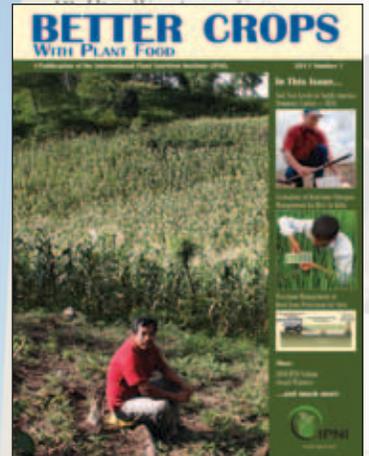
WITH PLANT FOOD

A Publication of the International Plant Nutrition Institute (IPNI)

2011 Number 2

In This Issue...

Nitrogen Utilization by Cotton



How the Aims of Optimal Crop Production
And Low Greenhouse Gas Emissions
Are Remarkably Similar....see page 16

Awards

IPNI Scholar Award

There were 20 graduate student recipients of the 2011 IPNI Scholar Award. Students from Africa, Australia/New Zealand, China, Eastern Europe and Central Asia, Latin America, North America, South Asia and Southeast Asia were selected as outstanding students enrolled in the science programs relevant to plant nutrition and management of crop nutrients.

Students in the discipline of soil and plant sciences including agronomy, horticulture, ecology, soil fertility, soil chemistry, crop physiology, and other areas related to plant nutrition are encouraged to apply: www.ipni.awards. Awards of USD 2,000 are presented to students who are candidates for the M.Sc. or Ph.D. degree.





Dr. Ji-yun JIN (third from right) was acknowledged by the Government of China with the Outstanding Researcher Award, Grain Bumper Harvest Program.



Dr. Mike Stewart (right) presenting the 2011 IPNI Science Award to Dr. Michael J. McLaughlin.

The 2011 IPNI Science Award was presented to Dr. Michael J. McLaughlin of The University of Adelaide and the Commonwealth Scientific and Industrial Research Organization (CSIRO). Dr. McLaughlin received a plaque and a monetary award of USD 5,000.

The IPNI Science Award is intended to recognize outstanding achievements in research, extension, or education, with focus on efficient management of plant nutrients and their positive interaction in fully integrated crop production that enhances yield potential and quality.

Awards Presented to IPNI Staff

Dr. Shamie Zingore received Recognition of Excellence to Mentoring by the African Women in Agricultural Research and Development (a project of the CGIAR Gender and Diversity Program).



Dr. Adrian Johnston (left) received the Prairie Certified Crop Adviser Program John Harapiak Award.

Dr. Munir Rusan received a grant from EU for the Olive Mill Wastewater Treatment and Reuse Project.



Dr. Ping HE was recognized on International Women's Day of 2011 at Beijing Great Hall of the People, with the National Outstanding Women's Award.

Dr. Shihua TU was recognized by the Sichuan Provincial Government for scientific achievement "Research on fertilization for major grain and economic crops, compound fertilizers development and application" ■.

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Research Support

Special Projects

Best Management Practices for Sustainable Crop Nutrition in Bulgaria *Nutrient Expert™* Development and Assessment

Global Maize

Global Maize Project in China: Liufangzi, Gongzhuling, Jilin Province
 Global Maize Project in India: Ranchi, Jharkhand
 Global Maize Project in India: Maize-Wheat cropping system in Northern Karnataka
 Global Maize Project in the United States: Ames, Iowa
 Global Maize Project in Russia: N. Tselina, Rostov Oblast
 Global Maize Project in Mexico: Celaya, Guanajuato
 Global Maize Project in Mexico: Toluca, México
 Global Maize Project in Brazil: Itiquira, Mato Grosso
 Global Maize Project in Brazil: Ponta Grossa, Paraná
 Global Maize Project in Argentina: Balcarce, Buenos Aires
 Global Maize Project in Argentina: Oro Verde, Entre Ríos
 Global Maize Initiative, Colombia
 Global Maize Project in China: Dahe, Shijiazhuang, Hebei Province

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Evaluating Nitrogen Sources for Corn on the Delmarva Peninsula

Michigan

Evaluating Sulfur in Michigan Corn Nitrogen Programs

New York

Comparison of Tissue Potassium and Whole Plant Potassium for Alfalfa Beta-testing the Adapt-N Tool in On-farm Strip Trials

Ohio

Impact of Phosphorus and Potassium Fertilization and Crop Rotation on Soil Productivity and Profitability

Ontario

Long-term Optimum Nitrogen Rates for Corn Yield and Soil Organic Matter in Ontario

Corn Hybrid Interactions with Nitrogen and Foliar Fungicides

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Evaluation of Ammonium Sulfate Nitrate in Virginia Snap Bean Production

Evaluation of Ammonium Sulfate Nitrate in Virginia Sweet Corn Production

Sulfur Fertility for Barley Production in the Mid-Atlantic

Northern Great Plains Region

Dr. Tom Jensen, Director

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Evaluation of Phosphate and Nitrogen Fertilizers Treated with Polymer Additives to Increase Fertilizer Efficiency

Large Urea Granules for Broadcast Application in No-till Barley Cropping

Large Urea Granules for Broadcast Application in No-till Spring Wheat

Large Urea Granules for Broadcast Application for No-till Cropping in Spring Wheat

British Columbia

Evaluation of Phosphate and Nitrogen Fertilizers Treated with Polymer Additives to Increase Efficiency

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Impact of Long-Term Application of Phosphate Fertilizer on Cadmium Accumulation in Crops

Montana

A Micrometeorological Study to Quantify Ammonia Volatilization Losses from Surface-Applied Urea in the Semiarid Northern Great Plains

Nitrogen Fertilization Methods for No-till Cropping of Winter Wheat in Central Montana

North Dakota

Nitrogen Recalibration for Corn in North Dakota

Saskatchewan

Evaluation of Urea Nitrogen Fertilizer Treated with Nutrisphere® Polymer Additive to Increase Fertilizer Efficiency

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California

Assessment of Alfalfa Yield Monitoring Technology to Improve Nutrient Use Efficiency

Relationship of Soil Potassium Fixation and Other Soil Properties to Fertilizer Potassium Rate Requirement

N₂O Emissions from the Application of Fertilizers: Source Partitioning

Western Nutrient Digest—A Regional Publication to Promote Nutrient Use Efficiency

Idaho

Root Scans to Document Fertilizer Response

Documenting Phosphorus Efficiency for Potato Production

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Comparative Nutrient Use Efficiency by Candidate Biofuel Crops

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Biomass and Macronutrient Accumulation and Losses in Switchgrass during and after the Growing Season

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Bahiagrass Production and Nitrogen Leaching from Various Nitrogen Fertilizer Sources

Nitrogen Rate Study for Potato Production in Northeast Florida

Louisiana

Validation of an On-Site, Active Sensor-Based Midseason Nitrogen Decision Tool for Rice Production in the Mid-South

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Survey of Weed Nutrient Removal Potential in Missouri Soybean

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Soil Fertility Management for High Population, Narrow Row Corn Production

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Evaluation of Sidedress Nitrogen Sources in Dark Tobacco

Evaluation of Sidedress Nitrogen Sources in Burley Tobacco

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Documenting Nutrient Deficiency and Accumulation Rate in Vegetables

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Effect of Long-term Nitrogen, Phosphorus, and Potassium Fertilization of Irrigated Corn and Grain Sorghum

Effect of Potassium, Chloride, and Nitrogen on Corn, Wheat, and Double-crop Sunflower Grown on Southeastern Kansas Claypan Soil

Applied Fertility Management for Irrigated Soybean Production

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Soil Test Phosphorus Level and Yield Potential

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Nutrient Removal by Fruit and Vegetable Crops in Texas

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Rates and Residual Effect of Potassium Fertilization in a Brazilian Soil

Soil Physical Properties, Dynamics of Nitrogen, Phosphorus, and Potassium, and Crop Yield as Influenced by Soil Compaction under No-Till

Brazilian Soil Fertility Survey (Phase 1)

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Exploration of Responses to Potassium in Western Uruguay

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Response of Chinese Cabbage to Different Timings of Fertilizer Application in Chongqing

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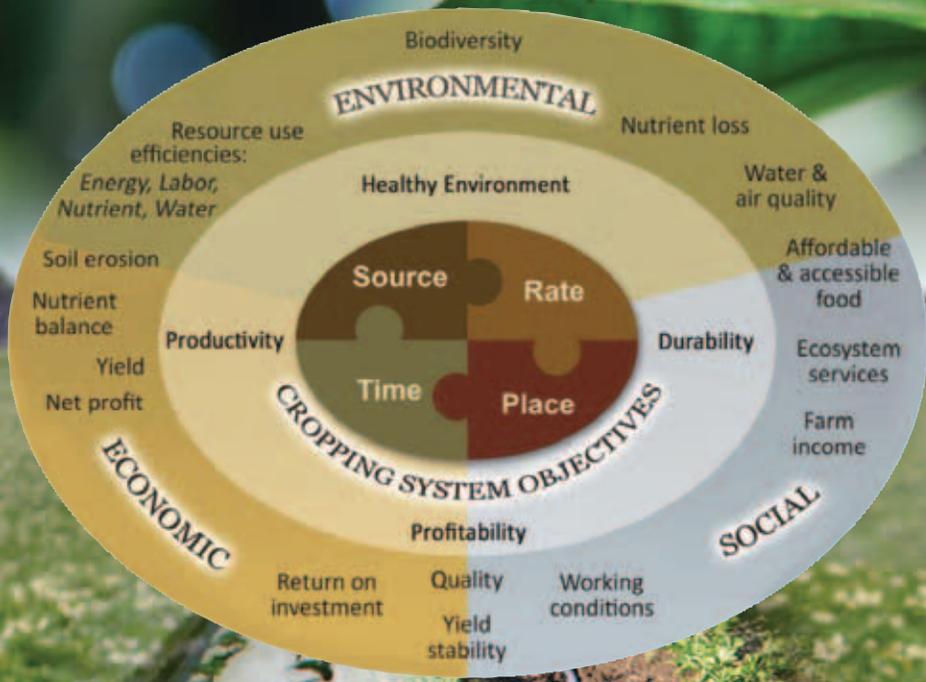
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