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Bringing hope, improving lives

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Rice feeds roughly half the planet's population and approximately three-quarters of a billion of the world's poorest people depend on the staple to survive. A carefully focused agenda for continued research on this vital crop is more imperative than ever. And if all goes as planned, in 2010—while the International Rice Research Institute (IRRI) is celebrating its 50th anniversary—the initiatives spelled out in the Institute's new Strategic Plan (the Plan) will already be starting to have impact.

This Plan, *Bringing hope, improving lives*, is also designed to enable IRRI to do its part in helping partners and nations across the globe to reach the United Nations Millennium Development Goals (MDGs) by 2015.

Certainly, the world has changed enormously since we developed our last strategic plan a decade ago. Recent scientific discoveries—particularly in genetics and genomics—now open up new opportunities to achieve impact that would have been difficult if not impossible as recently as the turn of the century. The reduction of poverty and the sustainability of the rice production environment, through the use of modern technology and the latest communication tools, are at the heart of our exciting and innovative Plan.

Developing the Plan took nearly 12 months. IRRI consulted widely among its partners and stakeholders and sought expert guidance throughout. During these deliberations, we concluded that the MDGs related to hunger, poverty, environmental sustainability, and nutrition and health formed a sound basis and direction for IRRI's future activities. So, we developed five strategic goals and seven research programs to achieve them to reflect this thinking.

Goal 1: Reduce poverty through improved and diversified rice-based systems

Achieving IRRI's first goal—Reduce poverty through improved and diversified rice-based systems—will take the Institute beyond its traditional focus on rice production (increasing productivity or “filling the rice bowl”), which required an emphasis on favorable irrigated areas, to “filling the purse,” a major effort to improve farmers' incomes in unfavorable rainfed areas. Nevertheless, rice supplies will need to remain plentiful to provide reliable food that even the poorest can afford. In Southeast Asia, South Asia, and sub-Saharan Africa, rice consumption in 2015 is projected to be, respectively, 13.4 million tons (11%), 22.3 million tons (13%), and 9.5 million tons (51%) above 2005 levels.

This means relatively less research emphasis for IRRI on yield gains for irrigated rice—for which there is now strong capacity among the national agricultural research and extension systems (NARES), particularly in Asia. Instead, IRRI's focus on intensive production systems will shift more to sustainability. In addition, by targeting the MDG on eliminating extreme hunger and poverty as our first strategic goal, we are opening profound new opportunities for IRRI to improve the economic and social well-being of poor rice consumers and farmers.

Program on raising productivity in rainfed environments: attacking the roots of poverty. Rainfed areas coincide to a large extent with regions of severe and extensive poverty where rice is the principal source of staple food,

employment, and income for the rural population. Up to now, success has been limited in increasing productivity in rainfed rice ecosystems—home to 80 million farmers on 60 million hectares. Rice yields in these ecosystems remain low at 1.0 to 2.5 tons per hectare and tend to be variable due to erratic monsoons. Poor people in these ecosystems often lack the capacity to acquire food, even at lower prices, because of poor harvests and limited employment opportunities elsewhere.

Our primary objective will be to enhance household food security and income in these rainfed areas of Asia. With rapid advances in genetics and genomics, the chances of developing high-yielding, drought- and flood-tolerant varieties for the rainfed system—and, consequently, helping farmers to diversify their farming systems and thus their income—are much greater now than ever before.

Program on East and Southern Africa: rice for rural incomes and an affordable urban staple. Sub-Saharan Africa is now one of the world's major poverty zones and Goal 1 targets this vast region as well. About 130 million people in East and Southern Africa (ESA) alone live in extreme poverty and more than 85% of these depend on agriculture. A large number of these people are rice consumers and many are small rice producers. A significant investment in agriculture is critical to eradicate hunger and poverty in ESA.

Rural poverty in the ESA region could be significantly reduced if the efficiency of local rice production were improved in the key rice-growing areas of Kenya, Mozambique, Tanzania, and Uganda. Our



research agenda here will also focus on enhancing small farmers' access and linkage to markets. We will collaborate closely with the Africa Rice Center (WARDA), the national programs, and advanced research institutes to capitalize on both the existing knowledge within the countries and the available international expertise.

Goal 2: Ensure that rice production is sustainable and stable, has minimal negative environmental impact, and can cope with climate change

It is critical that the stability and productivity of rice agroecosystems in Asia and Africa not be taken for granted and that their use by future generations not be jeopardized. Rice-growing areas are among the world's most enduring, environmentally sound, and productive agroecosystems, and increased rice production in recent decades has had a significant impact on poverty reduction.

Program on sustaining productivity in intensive rice-based systems: rice and the environment. Rice ecosystems provide basic commodities and regulatory services, including nutrient and water cycling, and biological control to reduce pest and disease outbreaks. Poor people often depend on these "ecosystem services" to provide their needs as they are often without infrastructure to obtain clean water, food, and fuel. Environmental sustainability and ecosystem services are threatened, however, by the loss of biodiversity, climate change, and inappropriate management systems often caused by land, water, or labor shortages.

Strategies are urgently needed to preserve the natural resource base while improving productivity in rice agroecosystems in the face of changing physical and socioeconomic environments. IRRI will focus on land management, biodiversity, water availability and productivity, and the impact of climate change to develop and promote technologies and options to sustain rice-producing environments.

Goal 3: Improve the nutrition and health of poor rice consumers and rice farmers

Nutritional deficiencies, especially in women and children in both Asia and Africa, often go hand in hand with extreme poverty because poverty is a major factor limiting diversity in the diet. Reliance on a single staple, such as polished rice, does not provide the requisite suite of minerals and vitamins necessary for healthy growth and development and



leads to widespread nutritional deficiency in many of the 1.2 billion people in Asia and sub-Saharan Africa living in extreme poverty.

Program on rice and human health: overcoming the consequences of poverty. This program will bring together the multiple rice biofortification projects (including the HarvestPlus Challenge Program) and other health-related efforts that already investigate germplasm, farm practices, and policy options.

Underpinning maximum success in meeting many of the MDGs is the need to solve the widespread problems of health and nutrition that debilitate people and hinder economic growth. Poor nutrition is manifested in invisible nutritional deficiencies (hidden hunger) and in malnutrition (visible hunger). In addition, poor health in the context of rice cultivation may be related to chronic and infectious diseases from water and from vectors such as rodents and mosquitoes, as well as illness attributed to the improper handling of farm chemicals.

For much of the work in this program, the delivery chain includes partners in NARES for the co-development and deployment of germplasm

(seeds and the genetic material they contain) and agricultural practices. However, IRRI will greatly expand its interactions with the public health sector in developing countries, for both policy and delivery effectiveness.

This process has already begun in the Golden Rice Network for India and the Philippines and this will serve as a model for other products. The existing structures in the Golden Rice Network and in HarvestPlus have already brought together many of the relevant national and regional institutions needed for impact.

Goal 4: Provide equitable access to information and knowledge on rice and help develop the next generation of rice scientists

Developments that will affect all of the efforts mentioned so far are the rapidly increasing availability and affordability of information and communication technology, such as the Internet, mobile phones, and powerful computers. These new technologies have created important opportunities to allow people with common interests to form communities, communicate, and collaborate.

They have also raised new obligations for IRRI to curate, exchange, and share not only its own body of information, data, and experience but also that of the world's knowledge about rice in all its forms. This will not only enhance global rice research efforts but also empower developing-country rice scientists with state-of-the-art information and knowledge and their associated tools.

Program on information and communication: convening a global rice research community. This effort will build on many global investments in information and technology within and outside IRRI's parent organization, the Consultative Group on International Agricultural Research (CGIAR).

Through this program, we are formally attempting to consolidate all IRRI research and development on information and communication technology for rice science and extension under a single coordinated activity. We plan to place bioinformatics and communication tools directly in the hands of crop scientists,

extension agents, and farmers to deliver impact through two major pathways, which will enhance the capacity of IRRI's six other research programs to deliver impact more effectively.

The first pathway is Internet dissemination via a World Rice Community Portal of restructured and cross-linked information on crop science and extension. The second pathway is direct engagement of science and extension communities using current communication technologies, both new, such as Web portals, videoconferencing, and cell phones, and traditional, such as radio and television.

Goal 5: Provide rice scientists and producers with the genetic information and material they need to develop improved technologies and enhance rice production

Another ingredient in the mix that will continue to contribute to the impact of IRRI's research agenda is the rice germplasm it has assembled over nearly half a century. IRRI now maintains, on behalf of humanity, the world's most complete and diverse collection of rice germplasm and this leads to our fifth and final goal.

Program on rice genetic diversity and discovery: meeting the needs of future generations for rice genetic resources. There are still significant gaps in IRRI's germplasm collection and, despite the advanced state of knowledge of the rice genome, information is scant on what diversity of genes exists within the rice gene pool, what these genes do, and how they may help meet the needs of rice producers and users. Meanwhile, genetic erosion in the field continues.



We expect a greater demand for specific genetic resources to address production and environmental problems in the future. This will translate into a greater demand for the genetic knowledge and tools that are needed to identify and use resources that meet specific needs.

Through genomics (the science of discovering genetic structure, variation, and function, and the interrelationships among these), genetic knowledge can now be integrated across species, leading to accelerated discovery of gene functions.

Furthermore, genome-wide analysis has the potential to reveal new insights about genetic pathways, and create new opportunities to meet both anticipated and unforeseen challenges.

Bringing together germplasm conservation, diversity analysis, and gene discovery under this single program presents a unique opportunity to maximize the utility of conserved and customized germplasm. This program will offer a comprehensive, well-documented germplasm base, a public research platform to enable gene identification, and genetic knowledge for priority traits. Building on the investments and achievements made in germplasm characterization, functional genomics, and bioinformatics, IRRI is poised to play a major role in gene function discovery, applications of genetic knowledge, and conservation and sharing of genetic resources.

Policy support and impact assessment

One last new program, which will be critical to achieving the five Plan goals, is *Rice policy support and impact assessment for rice research*. The impact of rice research on poverty reduction and environmental sustainability depends on policies and appropriate technologies that address farmers' livelihood needs.

To effectively set research priorities, we must understand the broad trends in socioeconomic and policy environments that affect the economics of rice production. This involves analyzing trends in rice production and consumption at national and



subnational levels and shifts in comparative advantages in rice production relative to other crops across regions and ecosystems.

IRRI aims to provide sound advice to policymakers, research managers, and donors regarding research priorities and the design of agricultural interventions through policy analyses, livelihood studies, and impact assessments focused on rice-based systems of Asia.

By making regional comparisons of rice economies and associated livelihoods, the program will help produce a global view of the drivers of change and their impacts. In addition, we will develop research approaches and tools that will have wider application for policy research and impact analysis. We will also closely partner with NARES to help build their capacity for broader socioeconomic and policy analyses of the agricultural sector. NARES, sister CGIAR centers, and advanced research institutes will all have key collaborative roles in the program.

Visionary frontier research

IRRI has a 46-year history of investing in visionary “frontier” research—research that, when successful, has revolutionized agriculture. The original frontier project was none other than the incorporation of semidwarf genes to create the modern high-yielding varieties that began with the release of IR8 40 years ago and spurred the Green Revolution in rice.

Three new Frontier Projects, involving work on drought tolerance, climate change, and produc-

ing a more productive and efficient rice plant are intended to accentuate the Institute's commitment to achieving its new goals. They will constitute novel and focused research on problems of strategic importance to future rice production and the environment. The projects will be undertaken by multi-institutional, international research teams, and we expect that significant portions of the research will be conducted at collaborating institutions in both developed and developing countries.

Drought and productivity in unfavorable rice environments (tied to Goal 1). Recent IRRI research has shown that the drought tolerance trait is strongly influenced by genes and gene networks with large effects. This project will scale up their detection, analysis, and delivery for use in marker-aided breeding. By incorporating genes for this trait from rice and other species into widely grown rice varieties, technologies can be developed with national agricultural research systems and provided to farmers to enhance and stabilize their rice yields and income.

Climate change and sustainability (tied to Goal 2). Climate change brings new problems for the sustainability of rice production. Further, changes in air quality and composition, acid rain, and Asian "brown" clouds will produce a new bio-climate for food production systems. Rice cultivation is often viewed as a contributor to climate change through the production of greenhouse gases. Given the essential role of rice in the food system, solutions must be sought that not only minimize the impact of rice production on the environment but also sustain productivity and environmental quality. Strong science will decipher the causes and effects involved, improve germplasm adaptation to expected future climatic conditions, and mitigate the negative effect of agriculture on climate.

A much more productive and efficient rice plant (tied to Goal 5). Plants like maize and sorghum have a more efficient photosynthetic mechanism (called C4) for converting energy to biomass than rice (a so-called C3 plant). C4 plants are also more efficient in nitrogen and water use, and are generally more tolerant of high temperatures. Genomic sciences and comparative bi-

ology may be able to break the yield ceiling of rice and enhance its water- and nitrogen-use efficiency by changing the photosynthetic mechanism in rice to that of the more efficient plants. IRRI has formed a C4 rice consortium of senior scientists from both advanced research institutes and developing countries to chart and conduct research to develop a C4 rice plant.

Conclusion

We have identified five strategic goals, have set targets by which our performance can be measured, and have established seven programs to achieve them. While the targets are realistic, they still remain challenging for all of us. The new Plan endeavors to take us over a modest 9 years so that we can contribute significantly to reach the MDGs by 2015. Nevertheless, much of the work outlined here today to bring hope to millions and improve their lives will obviously extend well beyond that date.

So, I believe IRRI's future is certainly something truly to get energized about and that, all-in-all, we are well positioned to move forward aggressively and take advantage of new opportunities and, most importantly, address some very difficult challenges that we only dreamed of hitting not too many years ago. IRRI is truly reinvigorated and is clearly relevant to the MDGs broadly accepted by the global community. I am excited about what IRRI will accomplish over the next years and am sure that you our partners and colleagues will join in and support us.

For more information on IRRI's new Strategic Plan, please go to <http://www.irri.org/BringingHope/ImprovingLives>.

