CGIAR

AfricaRice

More than production:
Policies for the African rice sector

Africa Rice Center (AfricaRice) – Annual Report 2013

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About Africa Rice Center (AfricaRice)

AfricaRice is one of the 15 international agricultural research centers that are members of the CGIAR Consortium. It is also an intergovernmental association of African member countries.

The Center was established in 1970 by 11 African countries. Today its membership comprises 25 countries, covering West, Central, East and North African regions, namely Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Côte d'Ivoire, Democratic Republic of Congo, Egypt, Gabon, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Madagascar, Mali, Mauritania, Niger, Nigeria, Republic of Congo, Rwanda, Senegal, Sierra Leone, Togo and Uganda.

AfricaRice is implementing its Strategic Plan through the CGIAR Research Program on Rice, known as the Global Rice Science Partnership (GRiSP), the Rice Task Force mechanism and a network of Rice Sector Development Hubs that are being set up across Africa to concentrate R&D efforts and connect partners along the rice value chain.

AfricaRice temporary headquarters is located in Cotonou, Benin. It has outreach stations in Côte d'Ivoire, Nigeria, Senegal and Tanzania. Research staff are also based in Liberia and Sierra Leone.

For more information visit: www.AfricaRice.org

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AfricaRice

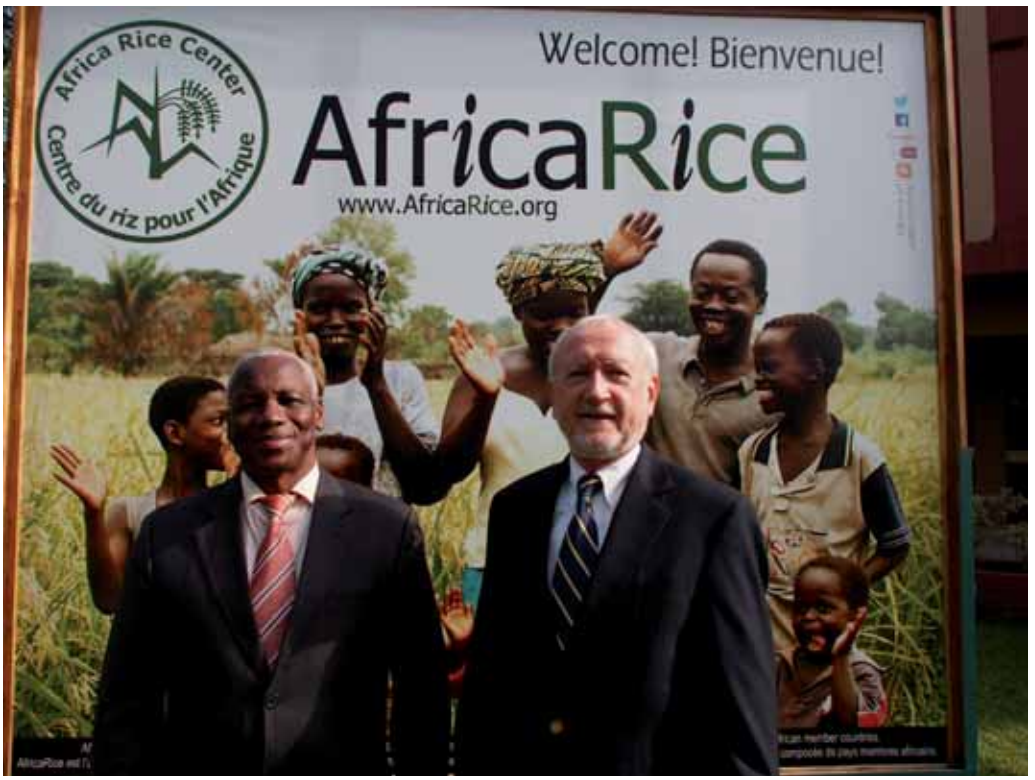
Message from the Board Chair and the Interim Director General

The year 2013 was a challenging one for AfricaRice, characterized by three landmark events: the Third Africa Rice Congress, the 29th Ordinary Session of the AfricaRice Council of Ministers and, the most challenging of all, the exciting — and yet bittersweet — departure of the former Director General, Dr Papa Seck upon his nomination as Senegal's Minister of Agriculture and Rural Equipment. Dr Seck left AfricaRice almost immediately after this announcement in order to take up this important assignment.

At the same time, AfricaRice stepped up its research and development activities by launching or growing several important initiatives. In this year's message, we would like to introduce the Annual Report by providing an overview of our progress on a number of fronts.

The Third Africa Rice Congress, held in Yaoundé, Cameroon, 21–24 October, emphasized the need to invest in the modernization and mechanization of Africa's rice industry and aggregation of farm output, while safeguarding the land rights of smallholders and improving livelihoods. There was also a call to establish world-class research infrastructure in Africa to identify rice genetic materials for resistance to major biotic and abiotic stresses, and to strengthen the rice sector development hub network and other rice-related research, extension and capacity-building efforts for greater and faster impact along the rice value chain. See the second feature in this year's report for further information on the Congress (page 17).

The 29th Ordinary Session of the Council of Ministers was held in N'Djamena, Chad, 10–11 December,



Chair of the Board of Trustees, Dr Peter Matlon (right), with Interim Director General, Dr Adama Traoré

under the chairmanship of Hon. Moussa Mahamat Agrey, Chadian Minister of Agriculture and Irrigation. The Council recommended a new timeline for the recruitment of a new Director General, with selection by the Board in September 2014, so that the new incumbent would be in post by January 2015.

A number of resolutions were also passed by Council urging AfricaRice to:

- Step up capacity-development efforts along the rice value chain
- Further increase support to member countries in the provision of quality seed
- Strengthen partnership with the African Union in AfricaRice activities
- Continue efforts to increase the number of member countries and encourage member countries to pay their contributions
- Open a regional research center in Central Africa in response to strong demand from the countries of that region.

The Council officially welcomed Rwanda into the Association during this Session. Thus, AfricaRice now has a membership of 25 African states. The Rwandan government has recognized rice as one of the country's major staple crops and aims to achieve self-sufficiency in rice production and substantially raise the competitiveness of local rice. Rwanda has also indicated its willingness to back AfricaRice's initiatives in East and Southern Africa.

The Council recognized the important contribution of the Benin government, which has hosted AfricaRice's temporary headquarters since 2005, and approved a phased plan to return AfricaRice's headquarters to Côte d'Ivoire, with the understanding that the Ivorian government fulfills its commitments to the Center.

A Center Development Plan was unveiled late in the year to complement the Center's 2011–2020 Strategic Plan. It will be reviewed regularly to ensure that the Center can respond in a timely manner to new strategic choices and regional and global developments. In summary, the Plan is based on the following principles: a decentralized mode of operation; long-term stable funding; strengthened in-house and national agricultural research systems' (NARS) capacities; and efficient and client-oriented support services. Over the period 2014–2020, it is anticipated that AfricaRice will return its headquarters to Côte d'Ivoire and establish or further strengthen Regional Centers in West Africa, East and Southern Africa, and Central Africa, each consisting of one or more stations. Each of the Regional Centers will focus on specific groups of countries and rice environments through multidisciplinary research teams, headed by a regional representative.

AfricaRice is providing targeted support and interventions to specific countries with special needs (Liberia, Nigeria and Sierra Leone) at their request to assist in the development of their rice sectors. Specifically, in 2013, country offices were opened in Liberia and Sierra Leone to coordinate new projects, mostly related to capacity-strengthening under the umbrella of the Word Bank-funded West Africa Agricultural Productivity Program (WAAPP).

As of December 2013, two internationally recruited staff are based in Sierra Leone and three staff (one internationally recruited) in Liberia. A new AfricaRice office was also opened in Abuja, Nigeria within the Federal Ministry of Agriculture in April. Three staff (seed systems specialist, value-chain specialist, extension agronomist) were recruited to support Nigeria's Rice Transformation Agenda.

During 2013, the AfricaRice Risk Management Committee increased its focus on identifying and mitigating risks by establishing a Risk Management Unit. The Unit is comprised of the Risk Management Officer, Legal Advisor, Internal Auditor and the Head of Security. The Unit will support the Committee by operationalizing AfricaRice's risk management strategy and policy. The Unit has trained all staff

at AfricaRice headquarters and in the outstations (Côte d'Ivoire, Nigeria, Senegal and Tanzania) on the importance and process of risk management, and facilitated the development of a risk register.

To demonstrate that rice farmers in Africa can access the next generation of high-performing rice varieties after the upland and lowland NERICAs, a new generation of improved rice varieties, called 'ARICA', was launched in 2013 (*see* Research in brief item 'First fruits of the Africa-wide Rice Breeding Task Force: ARICA', page 32).

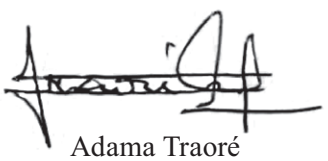
In response to demand from rice stakeholders across Africa, the Africa-wide Rice Mechanization Task Force was established in July 2013, involving partners from both the public and private sectors. This is the sixth Task Force to be established since 2010, and brings the task force mechanism up to full strength.

The year also saw continued efforts to ramp up the on-farm impact of AfricaRice research. The rice sector development hubs network introduced by AfricaRice to concentrate R&D efforts and connect partners along the rice value chain continued to grow. By the end of 2013, some 68 rice Hubs had been identified by NARS in 24 countries across Africa.

We recognize that long-term impact requires improving capacities of development partners across the continent. Consequently, AfricaRice increased its practical group training focused on development partners, particularly from the public sector and NGOs, with whom our researchers work within and around the rice Hubs. To facilitate information exchange among actors within the Hubs, we created a virtual platform called Rice *e*Hub (www.ricehub.org). It will help capture knowledge from national partners and has started a catalogue of scalable technologies. Four pilot countries had successfully created their own pages within the Rice *e*Hub by the end of the year.

Over the years, we have been able to increase our research-for-development activities and support operations without a similar increase in human resources. As this was becoming a major bottleneck and putting too much strain on the current staff, a special effort was made in 2013 to fill several critical positions in both internationally recruited staff and postdoctoral fellow, and general support staff categories. In 2005, the Center employed or hosted 46 internationally recruited staff (4 hosted). By the end of 2013, this had grown to 72 (3 hosted, including postdoctoral fellows and long-term consultants).

All in all, 2013 has been a very eventful and successful year for the institute. We would like to take this opportunity to thank Dr Papa Seck for his boundless energy and all his efforts in leading AfricaRice to its current position: that of a pan-African rice research for development organization of 25 states and a solid member of the renewed CGIAR, with the ambition to turn the rice sector into an engine for sustainable and equitable economic growth across Africa. We wish him well in his new position, where we know that he will continue to support rice R&D, not only in Senegal, but across the continent.



Adama Traoré

Peter Matlon

More than production: Policies for the African rice sector

AfricaRice's policy work has taken a high profile at the Center since the arrival of former Director General Papa Abdoulaye Seck in 2006, a year before the 'rice crisis'. Our policy work is not by any means finished. The past few years have seen policy emphasis shift to include the whole value chain that is involved in meeting the qualitative and quantitative demands of African rice consumers.

Production on the rise

Rice production in sub-Saharan Africa changed gear after the rice crisis hit in 2007, the result of a combination of pre- and post-crisis responses to the need to move away from dependence on imports. The figures speak for themselves: according to United States Department of Agriculture (USDA) data, rice production grew by an average of 3.2% per year over the period 2000–2007, and by 8.4% per year from 2007 to 2012. Total production rose by just 2.8 million tonnes (Mt) over the 7 years prior to the crisis, and then by 8.4 Mt over the following 5 years. Meanwhile, overall rice yields had been growing only slowly at 11 kg/ha over the period 1961–2007, jumping to 108 kg/ha per year thereafter — a staggering 30% increase in productivity in 5 years. Between 2000 and 2007, some 76% of the increase in total rice production

Increasing production can mean increasing field sizes: Rice farmers of Fogera District, northwestern Ethiopia

was attributable to expansion of the rice area, while between 2007 and 2012, some 71% was attributable to the yield increase.

Supply, supply, supply

The Coalition for African Rice Development (CARD) was created in the midst of the crisis with a goal of doubling continental production by 2018. CARD, an initiative of the Japan International Cooperation Agency (JICA) and Alliance for a Green Revolution in Africa (AGRA), is a consultative grouping of bilateral and multilateral development partners and African and international institutions. Partners in CARD include the African Development Bank (AfDB), Food and Agriculture Organization of the United Nations (FAO), Forum for Agricultural Research in Africa (FARA), International Fund for Agricultural Development (IFAD), International Rice Research Institute (IRRI), Japan International Research Center for Agricultural Sciences (JIRCAS), New Partnership for Africa's Development (NEPAD), the World Bank and AfricaRice. CARD encouraged more than 20 countries in sub-Saharan Africa to develop national rice development strategies (NRDS) to implement this ambitious program.

In a review of the then existing 19 NRDS, former AfricaRice agricultural economist Matty Demont pointed out in a publication in *Global Food Security* journal that the programs were almost entirely focused on productivity.

Domestic supply is clearly important if the region is to meet the local demand for rice, predicted to be in excess of 31 Mt in 2020 (*see* 'Third Africa Rice Congress', page 17). While many still look for, hope for, or drive toward a green revolution in rice in Africa, one has to bear in mind the strong differences between Africa and Asia. The rice green revolution in Asia was based on input-responsive varieties and massive inputs, especially in terms of fertilizers and water. One might say that the green revolution for rice was an irrigation revolution. Most rice workers in Africa will tell you that Africa's rice production area is dominated by rainfed farming.

In an analysis of data from 16 sub-Saharan African countries for which NRDS are available, AfricaRice agronomist Kazuki Saito and Deputy Director General Marco Wopereis determined that higher national average *yields* were directly related to a greater share of irrigated rice in the total rice area. Similarly, increasing national average *yields* over two periods (before and after 2000) were related to increases in the proportion of the rice area that was irrigated. It seems evident that the most rapid increases in *productivity* are going to be achieved in those countries that have the expertise and environments to establish new irrigation schemes. In all but 2 of the 16 countries analyzed, existing and targeted irrigation areas account for less than 35% of the country's potential. There is therefore huge scope for expansion of irrigated rice farming, which is key to improved national average yields and therefore production.

Rice field near Booker Washington Institute, Kakata, Liberia

Papa Abdoulaye Seck[1]

Papa Abdoulaye Seck, a specialist in agricultural strategy and policy analysis from Senegal, was appointed as AfricaRice Director General in October 2006. From that moment until his departure in September 2013 — when he was nominated by the President of Senegal to become Senegal's Minister of Agriculture and Rural Equipment — the winds of change that swept across the Center were unmistakable.

Seck's vision and commitment to the goals of AfricaRice have transformed the Center. He has been an outstanding spokesperson for effective economic policies to transform the rice production of African countries, of the kind that have enabled several national governments to formulate favorable rice policies and increase rice availability to their poorest citizens. Consequently, AfricaRice has become a catalyst for the remarkable visibility of the rice sector in sub-Saharan Africa as an entry-point for food security and poverty reduction.

Inventing a new type of scientist

On joining AfricaRice, Seck reiterated his strong conviction that Africa would develop either through science and technology or not at all. "One of my cherished dreams has been fulfilled — to be in a strategic position to serve Africa better because this Center is without doubt an invaluable tool to develop a more vigorous African rice sector."

As part of his new vision and strategy, Seck put forward the idea of a 'total researcher'. According to him, the need of the hour for Africa was a total scientist who would not just confine him- or herself to a laboratory or research station, but would also be able to listen, understand and address the real problems of end-users, develop winning project proposals, generate relevant knowledge and technologies, communicate effectively with various types of partners, anticipate problems and be ready with options.

The ever-popular Papa Seck with some of those he has helped

"In brief, in today's world, the duties of a 'total researcher' cover fundraising, obtaining reliable scientific results, effective communication and anticipation of future research needs," he explained. Spelling out the key principles of his new vision — transparency, equity, scientific excellence, interdisciplinarity, systems approach, strengthening of the NARS and openness towards all partners — he called for a change in attitude among researchers and research administrators.

Putting rice on the policy agenda of African countries

Seck's initiatives in 2006 and 2007 to pre-empt the looming rice crisis have been documented elsewhere (*see*, e.g., *Lessons from the Rice Crisis: Policies for food security in Africa*, AfricaRice, 2011).

"Relying so much on rice from other countries is a recipe for disaster for Africa," he remarked. "We are convinced that the future for rice farming lies in Africa. Unlike Asia, this continent has great untapped potential, which can be seen in its large tracts of land and underutilized water resources."

To respond to the 2007–2008 rice crisis, many African governments implemented policies and projects that

1. Based on Mohapatra S. 2014. Papa Abdoulaye Seck: A passionate advocate of research for Africa's development. *Rice Today*, 13(1): 36–37.

facilitated smallholder farmers' access to improved technologies by improving availability of subsidized certified seed and productivity-enhancing inputs such as fertilizer and farm machinery. This flurry of policy activity has had a positive impact on rice production in sub-Saharan Africa.

The concerted efforts of Seck and others have succeeded in putting rice firmly on the policy agenda of African countries. There is renewed commitment to the promotion of domestic rice production.

AfricaRice's research and its effective communication to policy-makers has been significant in framing the challenges, opportunities and policy options for the development of domestic rice production, and for increasing the productivity and profitability of the rice sector.

Transforming the Center

Seck was a vocal advocate for increased investment in rice research and greater ownership of AfricaRice by African countries. Several new countries have now joined from the central, eastern and northern parts of the continent, increasing the number of AfricaRice member countries from 17 in 2006 to 25 in 2013.

In addition to this geographic expansion, AfricaRice has transformed itself in many other ways. Its budget has tripled since 2006. This in turn has helped to increase substantially the number and volume of joint rice projects covering member states.

Commending Seck's achievements, the AfricaRice Board of Trustees stated, "He has left behind an exceptionally well-managed, financially sound and scientifically vibrant organization."

Stronger partnership

A solid believer in the power of collaboration to benefit from comparative advantages, Seck — together with IRRI Director General Robert Zeigler — made history in 2006 by committing AfricaRice and IRRI to a global partnership for rice research.

"We have to generate knowledge and technology which can have an impact in Africa by pooling together our resources, our intelligence and our efforts. Alone, it will be impossible for anyone to implement an effective research agenda in Africa, but together we can succeed," said Seck. This partnership set the stage for the launch of the CGIAR Research Program on Rice, known as the Global Rice Science Partnership (GRiSP) in 2010.

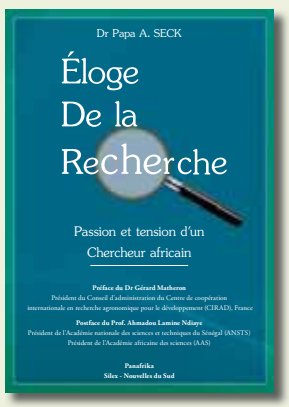
Enduring passion for research

Seck has received many awards and distinctions, including the 'Légion d'honneur' — France's highest distinction — but he wears his fame lightly. In Senegal, he is known as 'Ndanaane', which in Wolof (local language) means 'a star' or 'an erudite' who masters many subjects.

He is justifiably proud to be a member of the Senegal Academy of Sciences and Technologies, the African Academy of Sciences, and The World Academy of Sciences.

Reminiscing about his childhood and youth, Seck recalls that when he was asked to list his top three choices of profession, he simply replied "research".

"Research has remained my passion for almost 30 years." (Seck PA. 2012. *Éloge de la recherche : Passion et tension d'un chercheur africain* [In praise of research: Passion and tensions of an African scientist]. Panafrika Silex Nouvelles du Sud, Dakar, Senegal.)



Upgrading the value chain

Increasing domestic production on its own may not be enough to tilt the balance toward self-sufficiency. For example, Senegal boosted domestic production in 2008 in response to the crisis, but according to Demont (2013), "when rice farmers [brought] the rice surplus generated by the program to market, the market was temporarily flooded as there was no commensurate increase in demand for local rice, resulting in a steep decline of prices." This story is likely to be repeated elsewhere on the continent, especially in coastal countries that import large quantities of rice and whose urban populations have become accustomed to the quality attributes of imported rice.

AfricaRice consequently added its voice to those of the World Bank, United Nations Conference on Trade and Development (UNCTAD) and FAO in the call to widen investment to cover the whole value chain rather than simply focusing on production. Upgrading the whole value chain requires value-adding investments as well as investments in production.

AfricaRice has analyzed rice production chains in Senegal to determine the sequence of investments required for value-adding before tackling productivity. This analysis provides a model for other countries, especially those with import-biased markets (*see* 'Upgrading rice value chains: The role of policy sequencing', *AfricaRice Annual Report 2011*, pages 16–19).

In brief, coastal countries — where consumers favor imported rice — need to make their local rice look like the imported brands through quality-upgrading, branding and labeling. Meanwhile, coastal countries in which consumers favor local rice need to focus on maintaining the competitiveness of local rice on the local market (where it has to compete with better-quality imports). Conversely, landlocked countries that are somewhat shielded from import bias due to natural barriers are encouraged to invest in their internal marketing infrastructure, simultaneously shifting supply, adding value and maintaining demand for local rice. These countries may also benefit from a regional value-chain approach to rice development. Demont's research on the NRDS particularly highlighted Mali, which has ambitions as a rice-exporting country, and will therefore need to focus on value-chain upgrading (promoting trade, increasing coordination among stakeholders, providing marketing credit and developing export strategies).

Despite the poor image of local rice, further research confirmed that urban consumers were willing to pay a premium (even above the price of their currently preferred imported rice brands) for high-quality local rice. In terms of marketing, a key factor in import-biased countries seems to be making sure that local rice is packaged so that it blends in with imported brands on the shelf in urban markets. However, the appearance, grade, cooking characteristics and aroma then have to live up to the expectation of the branding — poor-quality rice masquerading as a high-quality product would only further undermine confidence in local rice.

The overall conclusion is that more resources need to be directed toward value-chain upgrading to add value to domestic rice production such that poor rice farmers have access to the large urban markets that are currently mainly served by Asian exporters. At the same time, however, the local rice needs to remain affordable for rural and urban consumers, particularly the poor.

Regional approach: The Africa-wide Rice Policy Task Force

Policy-makers have long suffered from a lack of high-quality, policy-relevant information about rice, due partly to a lack of national researchers. The Africa-wide Rice Policy Task Force seeks to remedy this by ensuring a critical mass of research through collaboration and standardization of methodologies. On behalf of the task force, AfricaRice has developed

Upgrading the value chain includes medium- and large-scale processing, storage and retail:

1 & 2. GADCO Rice Processing Unit, Fievie – Sogakope, Volta Region, Ghana;

3. Upland Rice Millers Co. Ltd, Jinja, Uganda;

4. Kanishe market complex, Accra, Ghana;

5. Upper Nun Valley Development Authority, Ndop, Cameroon.

standardized sampling, data-collection and data-analysis methods and conveyed these to the NARS through numerous training programs. These have been foundational in establishing quality rice statistics for the continent. (For more details, see 'Building African capacity on policy analysis and impact assessment', *AfricaRice Annual Report 2010*, pages 4–9; Lessons from the Rice Crisis: Policies for food security in Africa, AfricaRice, 2011.)

To further promote vital regional collaboration toward food security, the task force also specifically addresses regionalization through supporting the development of: (1) a regional rice development strategy; and (2) regional rice trade policies and harmonization of rice trade policies across countries and regions. Both of these are to be achieved in consultation with the regional economic communities.

Under these headings, the task force is involved in three activities: (1) the Economic Community of West African States (ECOWAS) Regional Rice Offensive (see next subsection); (2) lobbying ECOWAS to raise the common external tariff (CET) to 35% and analyzing the likely impact of such a tariff increase; and (3) feasibility studies on regional bulk buying of rice from the international market and regional rice storage.

An *ex-ante* impact study of the CET is being conducted in collaboration with the Network of Farmers' and Agricultural Producers' Organizations of West Africa (ROPPA) and Réseau de recherche pour l'appui au développement de l'Afrique (REPAD) in seven countries (Benin, Côte d'Ivoire, Ghana, Guinea, Nigeria, Senegal and Togo) and will be reported at a workshop in April 2014.

See 'Donor profile – European Union — Advocacy for appropriate rice policy and policy-related research', *AfricaRice Annual Report 2012*, pages 26–27, for further details on these initiatives, and 'Domesticating West Africa's rice market', *GRiSP in Motion: Annual Report 2012*, pages 14–15, for more on the CET.

ECOWAS Regional Rice Offensive

AfricaRice participated in the Technical Monitoring Group convened by ECOWAS to move the feasibility study for its Regional Rice Offensive forward. The group comprising Hub Rural, International Food Policy Research Institute (IFPRI), Laboratoire d'analyse régionale et d'expertise sociale (LARES) and AfricaRice drafted a complete program for the Offensive. This will be validated at a meeting of the ECOWAS task force in March 2014 and presented at the next full ECOWAS official meeting in 2014.

The members of the task force are: (1) officers in charge of rice national strategies; (2) representatives of regional networks of socio-professional organizations (ROPPA, RBM, APESS[1]), private sector (AAFEX), and civil society (POSCAO, AFAO), NGOs (Oxfam, VECO, SNV, WILDAF); (3) representatives of ECOWAS, West African Economic and Monetary Union (UEMOA), UNECA, NEPAD Planning and Coordinating Agency (NPCA/NEPAD), Permanent Interstate Committee for Drought Control in the Sahel (CILSS), AfricaRice, West and Central African Council for Research and Development (CORAF/WECARD), IFPRI, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), European Union (EU), IFAD, Canada, Japan, AFD; and (4) resource persons mobilized by Hub Rural and AfricaRice as part of their support for the technical facilitation of the process. We should be able to report the outcome of these meetings in next year's report.

"As an association of currently 25 member states, AfricaRice is well placed to conduct policy research and communicate results to policy-makers in Africa to facilitate evidence-based decision-making to the benefit of Africa's rice consumers and producers. This type of work will remain high on the Center's research agenda," says Wopereis.

1. Abbreviations are spelled out in the list that starts on page 104.

Case studies: Côte d'Ivoire and Sierra Leone

Côte d'Ivoire: Relying on foreign investment

The Ivorian Office national pour le développement de la riziculture (ONDR) is steering an ambitious national program to increase annual domestic production of quality milled rice to 1.5 Mt by 2016, rising to 2.1 Mt in 2018. Meeting this target would give Côte d'Ivoire the potential to export surplus rice. The program involves a wide spectrum of partners, including Direction générale des productions et de la sécurité alimentaire (DGPSA), Fonds Interprofessionnel pour la recherche et le conseil agricoles (FIRCA), Agence nationale d'appui au développement rural (ANADER), Centre national de recherche agronomique (CNRA), Ministère de l'Éducation supérieure et de la recherche scientifique (MESRS) and Institut national polytechnique Félix Houphouët-Boigny (INPHB).

The program aims to provide technical support in two main areas: (1) production, i.e. seed production, water management, mechanization of production and postharvest activities, improved crop management, and associated research and development; and (2) value addition, i.e. marketing and labeling 'Riz Côte d'Ivoire', development of private-sector involvement, public–private partnerships, processing and marketing.

The rice-producing areas of the country have been divided into 48 'rice pools' of about 70 km^2 each. Each pool will be led by a processing-unit operator, with the millers guiding the demand for seed and other inputs, and then pooling the paddy. It is envisaged that the pools will have an average capacity of 37,500 t of paddy each, giving a total of 1.8 Mt. The work in the pools will be monitored by ONDR, while ANADER will provide extension services. The estimated budget is 477 billion CFA (US$ 1 billion), expected to come from the private investors (64%), development partners (Banque ouest africaine de développement and AfDB, 22%) and the state (14%).

AfricaRice has been asked to work with CNRA to provide rice knowledge and technological support, especially making quality seed available. As a first step, AfricaRice multiplied 124 t of Foundation Seed of four popular varieties (WITA 9, WAB 56-50, WAB 638-1 and NERICA 1) in 2013.

The pool approach is being piloted at three mills in Gagnoa and farmers' contracts have been put in place with help from ANADER. An agreement was reached on the price of paddy in 2013, which was accepted by farmers and millers across the whole Gagnoa region.

Sierra Leone: Starting from farmer organizations

The entry point for rice sector development in Sierra Leone is farmer organizations. Former FAO farmer field schools have been converted into agricultural business centers (ABCs), which commercialize products with support from the government's Smallholder Commercialization Program.

Almost 200 ABCs have now been established, out of a planned total of 600. Many of them produce lowland rice. They have been equipped with a standard set of infrastructure, including mills, threshers and storage areas. The government is also helping farmers with rice commercialization by buying up rice during harvest and duty-free import of agricultural inputs. Discussions are under way about the possibility of establishing a national grain reserve to hold excess rice and manipulate rice flow for rice price adjustment when needed.

Some 4 hours drive from the capital Freetown lies the Sierra Leone Agricultural Research Institute (SLARI) Rokupr Agricultural Research Centre (RARC), the long-time home of mangrove-swamp rice research in West Africa. RARC has well-equipped laboratories (refurbished after the civil war that ended in 2002), but untrained staff, little electricity (only 7 hours a day, from onsite generators) and no spare parts for the equipment. However, a recruitment drive has brought in a cadre of young people to join the research teams.

AfricaRice and SLARI researchers are working to 'anticipate' adoption pathways. For example, one targeted technology is a new version of variety NERICA-L 19, developed under the Stress Tolerant Rice for Poor Farmers in Africa and South Asia (STRASA) project, that incorporates the *sub-1* gene for tolerance of submergence during the growing season.

'Anticipating' the adoption pathway would involve identifying target areas for the new variety (e.g. using remote sensing), clarifying release procedures and identifying seed-multipliers.

So far, three rice sector development hubs have been identified in Sierra Leone. Task force work in those hubs has identified the bottlenecks in and opportunities along the rice value chain, and farmers have started testing baskets of good agricultural practices (GAP). The hubs are proactively connecting with development partners from both public and private sectors.

The SLARI approach in Sierra Leone is to work through farmer organizations

Case study: Nigerian Rice Transformation Agenda

The Nigerian Rice Transformation Agenda (RTA) is an ambitious program to make the country self-sufficient in rice by addressing production and postharvest processing costs, the fragmented value chain and the poor quality of local rice.

"The Rice Transformation Agenda intends to adopt the value chain approach to form a nucleus estate around existing rice mills. Clusters of rice production will be identified and the farmers therein will be organized so that they can readily access inputs such as improved seeds, fertilizer, agrochemicals, and modern methods of production from extension services. Each cluster will use improved seeds of recommended varieties and supply paddy to the mill" (Federal Ministry of Agriculture and Rural Development, *Rice Transformation Action Plan*, Abuja, 9 September 2011).

The RTA initially targeted mills in lowland and irrigated rice areas in 20 major rice-producing states. The 'clusters' aggregate farmers to improve their access to improved technologies and reduce production and transaction costs. The government will subsidize seed, fertilizer and agro-inputs by 50% to encourage their uptake by farmers. While the RTA will expand the rice area by progressively rehabilitating existing irrigation schemes, the government will continue to subsidize water supply for irrigation by 50%.

As a public-sector-led initiative, the RTA will help forge links between farmers and private-sector credit sources through the Nigeria Incentive-based Risk Sharing for Agricultural Lending (NIRSAL). This is a crucial way to support mechanization by facilitating farmers' access to tractors, harvesters and threshers.

With funding from the Federal Ministry of Agriculture and Rural Development, AfricaRice recruited three staff members for the RTA in April 2013 — an agronomist/water-management specialist, a rice seed systems specialist and a rice value-chain/postharvest specialist. All three have been placed within the Federal Ministry in Abuja, where they are involved in a number of aspects of the RTA.

Sixteen hybrid rice varieties developed by AfricaRice are undergoing evaluation trials in Kano and Kubwa with the Notore Seed Company, and at the IITA–AfricaRice research station in Ibadan. Three hybrid varieties were selected for further testing from a yield-performance evaluation by Syngenta Seed Company, National Cereals Research Institute (NCRI) and the Rice Value Chain (component of the RTA) in Wushishi (Niger State). ARICA1, ARICA2 and ARICA3 are undergoing participatory evaluation in Kano and Kubwa in collaboration with NCRI. AfricaRice helped compile a report for the registration and release of non-AfricaRice varieties UPIA 1, UPIA 2 and UPIA 3. A submergence tank is being constructed in Kubwa to demonstrate submergence-tolerant varieties.

In partial fulfillment of the agreement with the Federal Ministry, AfricaRice produced 8 t of Breeder Seed and mobilized 220 t of Foundation Seed for the RTA in 2013. Meanwhile, 25 seed technicians from the national program were trained in Breeder Seed production, and 8 seed-production officers of Kojoli Seed Company trained in Certified Seed production and quality control.

With funding from the Federal Ministry, AfDB and the Canadian Department of Foreign Affairs, Trade and Development, a 2-week program was held in Ilorin in collaboration with the National Centre for Agricultural Mechanization (NCAM) at which 24 Nigerian and 5 foreign fabricators were trained to manufacture the 'ASI' thresher–cleaner.

Within just 2 weeks (a record), five prototype thresher–cleaners, dubbed 'Agricultural Transformation Agenda Threshers' (ATATs), were produced, each with a capacity of 2.5 t/h. These are being distributed to five dry-season rice-producing states (Jigawa, Kebbi, Niger, Sokoto and Zamfara), which will arrange to demonstrate the threshers in several locations in collaboration with the rice value chain–AfricaRice team.

Together with the USAID Maximising Agricultural Revenues and Key Enterprises in Targeted Sites (MARKETS II) project, the AfricaRice RTA team has

been tasked by the Honorable Minister of Agriculture to come up with proposals to address six emerging issues that will contribute to bridging specific gaps in the Nigerian rice value chain. This follows earlier joint reports to the Federal Ministry on the challenges faced by Nigerian rice millers, which resulted in a stakeholder dialogue that identified the problems.

These issues are related to: (i) the establishment of paddy-aggregation centers nationwide to ease millers' access to paddy; (ii) fixing paddy transport subsidies for millers located far away from main paddy production areas; (iii) examining import quotas, duties and levies as a basis for a policy framework on rice; (iv) developing a robust price-support mechanism for both farmers and millers to encourage incremental paddy and finished product output; (v) developing a mechanism for accelerated adoption of rice hybrids in Nigeria; and (vi) promoting an alternative energy source from rice husk for running mills. The team has delivered reports on items (i)–(iii), for which implementation modalities are being worked out in the Federal Ministry; work is ongoing on the remaining issues.

Two of the AfricaRice RTA team were involved in the national rice levy committee, which helped define the strategy to reinvest income from levies and duties on imported rice. They were also active members of the 'rice crack team' (one of the implementation teams of the World Bank-funded FADAMA III project to boost paddy output in Nigeria).

The presence of the AfricaRice team in Nigeria has not only increased the visibility of AfricaRice as a strong partner with the Nigerian government in the implementation of the RTA, but will also contribute significantly to the potential success and impact of the RTA on the Nigerian rice economy.

The ATAT thresher–cleaner produced by trainees at NCAM, Ilorin

Case study: Senegal strategy workshop

The revised national rice self-sufficiency program of Senegal — a presidential initiative — aims for self-sufficiency in production by 2017. To determine whether this goal is achievable, AfricaRice developed a spreadsheet that takes actual data and projects it into the future. This spreadsheet was used in a 2-day Senegal Rice Strategy Workshop in Saint-Louis, Senegal on 16–17 September 2013, to which representatives of all the actors in regional policy and planning processes were invited.

For each of the 10 rice-producing regions of the country, the regional development director came to the workshop with data on actual production, rice-area expansion rate and potential, and the time-windows available for each task in the cropping and postharvest calendars to optimize land use. These data were input to the spreadsheet, which had already been pre-loaded with basic information on seeding and fertilizer rates for target yields, and labor and machine requirements per task.

The output was two-fold: (1) projection of production from 2014 to 2018; and (2) calculation of the seed, fertilizer, equipment, training and staff required to achieve the goal, complete with costs. For seed, the projection included production of Breeder, Foundation and Certified seed; for staff, the projection comprised labor and advisers in terms of numbers and costs, the latter on the basis of one adviser per 200 hectares. The spreadsheet then integrated all the data at the national level.

Despite the initial concerns of most of the rice stakeholders present that the goal was asking "too much," the calculations convincingly demonstrated that paddy production of 1.6 Mt is indeed attainable by the target year of 2017, if greater attention is paid to rainfed rice systems in the south of the country.

Armed with this information, the Société nationale d'aménagement et d'exploitation des terres du Delta et des vallées du fleuve Sénégal et de la Faléme (SAED) will organize a one-day validation meeting in January 2014, at which the findings of the workshop will be presented to a complete range of rice-production stakeholders from all regions, including the director general of the Société de Développement Agricole et Industriel (SODAGRI, a rice scheme in the Kolda region, Casamance), representatives from agricultural-credit, market-development, crop-protection and farmer organizations, the national agricultural research institute, AfricaRice, 14 representatives of the Direction régionale du développement rural (DRDR), and coordinators from a number of projects with an interest in rice.

"Our aim now is to do this kind of planning in other countries," says Kabirou N'Diaye, leader of the AfricaRice Rice Sector Development Program. "Each one has its objectives laid out in its NRDS. This tool will help them to operationalize the strategy."

Third Africa Rice Congress

The Africa Rice Congress is the largest gathering of rice researchers and other rice stakeholders on the continent. It brings together not only those working in national and international research systems in Africa, but also those in other parts of the world whose research on rice benefits Africans.

"This is an important time for rice as an element of food security and more," said Peter Matlon, Chairman of the AfricaRice Board of Trustees in his speech at the opening ceremony. "Over the next 15 years, 330 million young Africans will be looking for employment."

Rice consumption in sub-Saharan Africa is growing at the expense of traditional staples like cassava, millet and sorghum, and demand far outstrips the continent's ability to produce. Consequently, almost all African countries are import-dependent. "Rice production in sub-Saharan Africa is 12 Mt right now, and another 12 Mt are imported," said Marco Wopereis, AfricaRice Deputy Director General at a briefing for journalists held before the Congress. "Assuming that the current impressive growth rate continues (8.4% per year since 2008), production in 2020 will be about 24 Mt, but by that time consumption will have reached 36 Mt, so we'll still be importing 12 Mt. However, the AfricaRice strategy aims at reducing imports in 2020 to just 5 Mt." This may not seem much in the grand scheme of Africa's potential for rice production, but it amounts to more than doubling production in just 8 years!

The Third Africa Rice Congress was co-organized by FAO, the Cameroon Institute of Agricultural Research for Development (IRAD) and AfricaRice. It brought together over 650 participants from 60 countries (including 35 African countries). Attendees included rice farmers, seed producers, rice processors, input dealers, agricultural machinery manufacturers, representatives from agricultural ministries, national and international rice research and extension communities, NGOs, donors and other development partners, and the media. They reviewed achievements to date in rice research for development in Africa and prospects for the future, under the main theme of 'Rice Science for Food Security through Smallholder and Agribusiness Development in Africa'.

Exposition of agricultural machinery and related technology at the Third Africa Rice Congress

Showcasing rice machinery and rice-based products

"New to the Congress this year were the emphasis on rice-based products and the outdoor exposition by agricultural machinery manufacturers and entrepreneurs," said Wopereis. "In fact, we thought the exposition so important that we re-ran it a second day!"

Mechanization of the rice value chain — from land preparation through weeding and harvesting to processing — are key features of the AfricaRice research-for-development strategy 2011–2020. "There are two main areas in the drive to increase rice production that require mechanization," says value chain and postharvest technology consultant Jean Moreira. "One is in reducing losses during, for example, harvesting, threshing, milling and parboiling. And the second is in field-level activities, such as improving land preparation, seeding, transplanting and weeding. Overall, mechanization can help improve the yield of both paddy and white rice."

The exposition featured manufacturers from Cameroon, Ghana, Mauritania, Nigeria and Senegal, who exhibited threshers, winnowers, a parboiling stove and posters of equipment being manufactured in their home countries.

"Cameroon is a major player in AfricaRice's mechanization work," says Moreira. "Within the context of the Canada-funded 'Support to rice research in Africa' project, the Cameroonian NARS has developed improved parboiling technology and a briquette-making machine [*see below*], and introduced the 'ASI' thresher–cleaner from Senegal."

The Cameroonian improved parboiling system comprises a parboiling unit with more uniform distribution of steam compared with the traditional unit, and a better stove. "The improved parboiling technology produced rice that was of high physical and eating quality compared with the traditional technology," said Sali Ndindeng, AfricaRice postdoctoral fellow in grain quality and postharvest technology, reporting on behalf of AfricaRice and the Cameroonian NARS at the Congress. Moreover, consumers were willing to pay more for the rice parboiled with the new system than for that processed with the traditional set-up. "The improved parboiling stove was more energy efficient … [it] reduced the exposure of the processor to heat during parboiling … and [is] easy to build at the village level."

The importance of a whole value-chain approach to research for development is also stressed in the AfricaRice strategy, covering everything from input markets through production to processing, quality control, branding, packaging and rice-based products. For the first time, exhibition areas at the Third Congress featured companies, NGOs and other organizations demonstrating a variety of rice-

The improved parboiling unit and stove developed in Cameroon

Exhibition of rice-based products at the Congress

based products, including cookies, cakes, drinks, 'pop-rice' and rice flour. "What we do with rice is vitally important," explains Wopereis. "At the current juncture, much locally produced rice does not meet consumers' demands in terms of quality. Of course, we are working to upgrade quality throughout the value chain, but what to do in the meantime?" Cookies and cakes are a simple way of making a useful product out of 'sub-standard' rice and have been proven to have a market, especially in Cameroon.

Rice processing also generates a number of by-products — for example, husk and bran. "Disposal of rice husk has become a serious problem. Huge amounts of rice waste [are] seen near rice mills," said Josiane Mbassi of IRAD in a presentation at the Congress. "Where Engelberg-type mills are common, the husk is usually mixed with bran, making both by-products [unsuitable] as livestock feed," due to the high amount of silica in the husk.

However, husk and mixed husk–bran can be made into useful fuel in the form of briquettes and subsequently used in processes like rice parboiling, a favored process in many parts of West Africa that improves milling recovery. IRAD and Yaoundé equipment manufacturer Les Taless-Siemef have developed a single-piston briquette-making machine, and an analysis of different composition of briquettes from this research was presented by Mbassi. (*See also* Box 'Africa-wide Rice Processing and Value Addition Task Force', *overleaf*.)

The Cameroonian briquette-maker and the briquettes in use (inset) in the improved parboiling stove

Africa-wide Rice Processing and Value Addition Task Force

In November 2011, AfricaRice launched the Africa-wide Rice Processing and Value Addition Task Force as a research group to address postharvest, processing and value-addition issues. The original members of the task force — Cameroon, The Gambia, Ghana, Mali, Nigeria, Senegal, Sierra Leone and Uganda — were participants in the 'Support to Rice Research in Africa' project supported by the then Canadian International Development Agency (now the Canadian Department of Foreign Affairs, Trade and Development).

Initial work focused on assessing postharvest practices in the rice sector development hubs, quantifying postharvest losses, and developing technologies to address the problems identified along the value chain. Working in two or three hubs per country, the task force conducted situational analyses in partnership with value-chain actors to identify bottlenecks along the rice postharvest value chain and propose achievable measures to upgrade the postharvest system in each hub. The task force has widened its membership, now covering a total of 15 countries with the addition of Benin, Côte d'Ivoire, the Democratic Republic of Congo, Ethiopia, Guinea, Niger and Tanzania.

Like the work of the Africa-wide Rice Agronomy Task Force in identifying 'good agricultural practices' (GAP — *see* 'Africa-wide Rice Agronomy Task Force', *AfricaRice Annual Report 2012*, pages 4–8), the processing and value-addition task force is able to identify 'GAP baskets for postharvest practices' for introduction, testing, adaptation and adoption in the hubs.

Within the Canada-funded project, the task force developed specific technologies for parboiling and briquetting. In collaboration with the Africa-wide Rice Mechanization Task Force, the Processing and Value Addition Task Force designed a briquette-making machine and an improved rice parboiler, giving their drawings to machinists who then constructed the items. The two task forces also worked together to introduce the 'ASI' thresher–cleaner and mini-combine to the hubs, with the Mechanization Task Force involved in the construction and fine-tuning, using the designers' drawings, and the Processing and Value Addition Task Force involved in evaluating the efficiency of the equipment.

"In terms of rice-based products, we noticed that some consumers were using high-quality rice to make flour for use in cookies and other products," says Sali Ndindeng, AfricaRice postdoctoral fellow in grain quality and postharvest technology. Given the availability of fine broken rice from both industrial-scale and small-scale rice mills, this seems rather wasteful of a high-quality product. "[The fine broken grains] have very low market value and are typically used in livestock feed," explains Ndindeng. "If we make it into flour, it is then available for making rice-based products of higher value than animal feed."

Ndindeng has developed recipes for making fortified rice-based products. "The AfricaRice Grain Quality and Postharvest Unit purchased a mineral and vitamin premix from The Wright Group, which we are suggesting is used at the milling level, so that the rice flour is already fortified when it leaves the factory," he says. "The other avenue we have pursued is to make use of local foods with nutritional benefits." A typical example of the latter is safou (*Dacryodes edulis*) fruit, which provides an oily powder that is rich in essential lipids and minerals and can be used as a partial substitute for butter in recipes. "By using *Dacryodes*, we can replace 'unhealthy' saturated animal fat with 'healthy' unsaturated plant fat in safou–rice cookies," says Ndindeng. "Both the mineral and vitamin premix and *Dacryodes* powder are ready to be scaled up within the hubs."

In common with its counterparts, the Processing and Value Addition Task Force has a training component, especially for those working on the ground in the hubs. For example, Cameroon, Ghana, Sierra Leone and Uganda hub workers have been trained on the collection of data for the generation of consumer-preference

maps. These maps display information on preferences and price for different rice types (parboiled or non-parboiled) from different locations in the country. This combines the power of geographic information systems (GIS), market analysis and grain-quality analysis on a single map.

Training has also been provided on sensory evaluation of rice and rice-based products. Hub grain-quality researchers received training on three types of test used for sensory evaluation of a product: discrimination, acceptance and descriptive test. Discrimination and descriptive tests are used in a sensory test involving a trained panel, while the acceptance test is used with consumers and does not require a trained panel. The discrimination testing methods included a paired comparison, duo-trio, triangular, ranking and scoring tests.

The acceptance test is used to measure consumer acceptability of a product and, in this case, three methods can be applied — paired comparison test, hedonic scale or ranking. The sensory attributes evaluated for these products included appearance, odor/aroma, consistency, texture and flavor.

Participants were instructed on factors that influence sensory evaluation and how to reduce errors when performing sensory evaluation. In addition, they received lectures and practicals on different types of sensory evaluation tests and how to analyze and interpret data collected from the different tests.

"In terms of moving forward in the hubs, my preferred outscaling route is the fortified flour," says Ndindeng. "With the introduction of rice grading, broken grains will be separated out and can be made into flour. So, at the same time, we increase the value of the rice for market (as it has a higher content of whole grains) and that of the broken grains — a double win for the processors. The rice flour itself has multiple uses, including for pastes, cookies, pasta and porridge. I am optimistic about this direction."

Acceptance tests provide a key measure of consumer acceptability of rice and rice-based products.

Rice knowledge hub

The Congress recommended the continuation of work to facilitate "rice knowledge exchange to achieve greater and more rapid impact across the rice value chain" to strengthen the rice sector. This is being achieved through ongoing work to expand the development hub network established by AfricaRice under its 2011–2020 strategy.

The Rice *e*Hub (www.ricehub.org) was established with the philosophy of co-creation and co-learning. It allows easy access to innovations for rice-sector development and empowers national partners to upload information about activities conducted within the rice sector development hubs. While the *e*Hub is in its early days, there are already portals for 5 of the 68 rice sector development hubs that had been established by the end of 2013.

A view of the Rice e*Hub web page (September 2014). A simple click on any Hub-marker on the Africa map leads the viewer to the dedicated page offering detailed information about that specific location. The 'Innovations' panel at left leads to extensive resources for development partners and farmers.*

The *e*Hub will provide online access to information and documentation on 'scalable technologies' that have already been developed, tried and tested in an African rice-farming context and proven their worth.

A good number of reference books and training manuals are already available via the *e*Hub, along with technical details of some tools (e.g. mechanical weeders), links to other websites (such as the weed identification tool, AFROweeds) and AfricaRice's growing collection of educational videos.

"As we upload more and more information on the technologies already available, we are building a valuable online resource for our partners, especially those working on the ground in the rice sector development hubs," says knowledge-management consultant Myra Wopereis-Pura. "Over the next year or two, we plan to have information on all existing technologies uploaded to the site and start to fill in the gaps where documentation is lacking."

Successful Congress

By most measures, the Third Africa Rice Congress was a resounding success (*see* Box 'Post-Congress evaluation by participants'). Over 650 participants attended the Congress from 60 countries, including 35 African countries. The discussions were enlightening and should pave the way for future work. The World Café session generated a lot of interest and ideas for participants to take away and work with.

"The Africa Rice Congress is now built into the GRiSP schedule of regional rice forums that comprises Africa (led by AfricaRice), Asia (led by IRRI) and Latin America (led by CIAT [International Center for Tropical Agriculture]). We plan the Fourth Congress for 2017. By that time we expect to see even more progress in the form of rice-sector development on the continent, increasing self-sufficiency levels, and a consequent reduction of imports from the international market," concludes Wopereis.

Post-Congress evaluation by participants

For a good many years, it has been a 'norm' for organizers of training and conference-type events (like the Africa Rice Congress) to seek feedback from participants in the form of post-event evaluations. With the advent of the internet and online survey tools, conducting such evaluations has become even easier.

Some 86 Congress participants completed the online post-Congress evaluation.

The overall rating of the Congress was "very good", with all but two respondents rating the event as "good" or higher.

Respondent-participants were also asked to indicate the value of the Congress in terms of six areas of potential benefit. For all six areas, the average of participant responses was in agreement, with most tending towards "fully agree". In descending order of achievement, these areas were:

- Opportunity to discuss with colleagues and partners
- New knowledge and insights [gained]
- Diffusion of research products and insights
- New partnerships [established]
- Opportunity to learn more about rice research in Cameroon
- Opportunity to organize or attend side meetings.

The ratings for the various elements of the Congress were on average "good" tending toward "very good". The most popular elements in this context were the mini-symposia, followed by the exhibits and the plenary sessions.

Realizing Africa's Rice Promise

Four years in the making (from conception to publication), *Realizing Africa's Rice Promise* provides a comprehensive overview of Africa's rice sector and ongoing rice research and development activities, indicating priorities for action on how to realize the rice promise in a sustainable and equitable manner.

With contributions from rice scientists from all over the world, the book discusses the challenges and opportunities related to: sustainably increasing rice production and rice productivity; enhancing rice quality and marketing; promoting conducive policies for smallholder and agri-business development; and strengthening impact-oriented rice research, extension and knowledge-management.

The book was launched at a special side-event at the Third Africa Rice Congress in Yaoundé, Cameroon on 21 October 2013.

At the launch, lead editor and AfricaRice Director of Research for Development Marco Wopereis commented, "It is 35 years since the publication of the first book on rice in Africa by Buddenhagen and Persley.[1] This new book *Realizing Africa's Rice Promise* was prompted in part by the rice crisis in 2007–2008. It is my sincere hope that it will not be another 35 years before a third volume can be produced; rather, I hope that in 5 to 10 years time, we will see a book entitled *Africa's Rice Success Story*!"

Realizing Africa's Rice Promise, edited by Marco C.S. Wopereis, David E. Johnson, Nourollah Ahmadi, Eric Tollens and Abdoulai Jalloh. 2013. 451 pages. CAB International, Wallingford, UK.

The hardback book is currently available from the publishers, CAB International, for £115/€150/US$ 220 via http://bookshop.cabi.org/. Electronic copies of the book and individual chapters are now available via the AfricaRice website.

1. Buddenhagen IW and Persley GJ eds. 1978. Rice in Africa. Proceedings of a conference held at the International Institute of Tropical Agriculture, Ibadan, Nigeria, 7–11 March 1977. Academic Press, London, UK.

Further reading

All of the outputs of the Congress are (or will be) available via the dedicated Congress website (www.africarice.org/arc2013/intro1.asp). Many of these materials make up the online proceedings, including:

- The Congress program and abstracts book
- Participants' presentations
- Reports of plenary and mini-symposia sessions
- Reports on the Ministerial dialogue and 'World Café' session
- Awards and recognition
- The Congress Declaration.

Recommendations of the Third Africa Rice Congress[1]

The Congress in its deliberations noted:

- The now rapid growth in rice production in sub-Saharan Africa (8.4% per year) resulting from key investments made by farmers, governments, the private sector and the donor community following the 2007–2008 global food crisis;
- That despite this rapid growth, the African continent continues to rely heavily on the world rice market to satisfy increasing demand, with imports reaching 12 million tonnes of milled rice in 2012, costing more than US$ 5 billion;
- That long-term food security in sub-Saharan Africa cannot depend on rice imports and that the African continent has the resources to feed itself in terms of rice and eventually to export rice;
- The importance of protecting Africa's rice farmers and urban consumers from world price fluctuations and inequitable trade;
- The tremendous employment challenge in sub-Saharan Africa, with 330 million young people expected to enter the job market over the next 15 years, and the opportunity that rice-sector development can offer for job and income creation, particularly in rural areas;
- That Africa's rice sector depends primarily on the efforts of small-scale resource-poor farmers and that development of the sector needs to create win–win opportunities for all involved in the value chain, in particular for women and youth;
- The importance of value-adding and demand-lifting investments to improve the competitiveness of local rice vis-à-vis imported rice and that such measures will often need to precede supply-shifting investments.

As a follow-up on the recommendations formulated at the Second Africa Rice Congress, the Third Congress confirmed:

- The progress being made by the scientific community since the Second Africa Rice Congress and the growing attention paid to quality-enhancing and marketing research;
- The establishment of six thematic Africa-wide Rice Research Task Forces, convened by AfricaRice;
- The need to more rapidly diffuse existing rice technologies and innovations by strengthening and linking rice research and development efforts across the continent;
- The continued shortfall in human resources in rice research and extension in Africa.

The Congress formulated the following recommendations for governments, farmer organizations, civil society, private sector, R&D partners, regional economic communities and donors:

Investments in Africa's rice sector

- Invest in modernization and mechanization of Africa's farming and in aggregation of farm output, while safeguarding land rights of smallholders and improving livelihoods;

1. Quoted from the full Declaration of the Third Africa Rice Congress (*see* http://www.africarice.org/ARC2013/Intro1.asp).

- Strengthen farmer organizations to ensure that farmers capture a fair share of any value added from the production, processing and marketing of locally produced rice and rice-based products;
- Stimulate the development of public–private partnerships and small-scale enterprises, and provide technical and business training to Africa's rapidly growing cadre of youth to help them find jobs in the rice sector;
- Combine supply-shifting, demand-lifting and value-adding investments to ensure rapid and sustainable development of affordable rice and rice-based products for different consumers;
- Consider the establishment of strategic regional rice reserves, relying on national stocks, but with coordination at the regional level to reduce price volatility;
- Establish minimum and maximum import tariffs agreed upon at the regional level that allow for raising import tariffs in times of low world market prices and vice-versa;
- Develop sustainable seed systems through coherent policies, strategies and functional public–private partnerships.

Investments in rice R&D and capacity-building

- Foster greater regional and international collaboration on the development and diffusion of improved varieties, ecological intensification of rice farming, and management of abiotic and biotic stresses in the face of climate change to sustainably meet increasing demand;
- Establish world-class research infrastructure in Africa to evaluate rice genetic material for major stresses and consumer demands, and ensure that progress made worldwide in rice genetics and breeding can be captured;
- Strengthen and expand the rice sector development hub network and facilitate rice knowledge exchange to achieve greater and more rapid impact across the rice value chain;
- Urge African governments and their development partners to substantially strengthen the retention and training of new research and extension staff, while updating agricultural curricula in vocational training schools and universities;
- Urge African governments to comply with the Maputo Declaration and increase the proportion of their national budgets allocated to scientific research to levels commensurate with international standards;
- Acknowledge AfricaRice as leading the African component of GRiSP to enable the pooling of resources, building capacity and aligning of national and international rice research agendas;
- Ask FAO to stimulate national, regional and global partnerships to develop Africa's rice sector, as part of the efforts of CARD and under the overall umbrella of the Comprehensive Africa Agriculture Development Programme (CAADP).

Improving climate-risk simulation for arid areas

It may come as a surprise to some that not all AfricaRice work falls directly within the Global Rice Science Partnership (GRiSP). The work reported here comes under the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

Whatever politicians with short-term agendas and their influential 'friends' in 'big business' might say, the vast majority of scientists in the world accept that human-induced global climate change is an ongoing and increasing threat.

Projections of the likely impacts of climate change in the future are based on complex computer simulation models. A major emphasis in climate simulation modeling is determining the likely impact of climate change on agriculture.

The idea of crop modeling is nothing new. AfricaRice has long been involved with models that simulate crop development and predict planting dates to avoid the worst of seasonal stresses. In the mid-1990s, AfricaRice researchers helped develop the model ORYZA_S by combing two existing models: ORYZA1, a rice crop model developed by Wageningen University and IRRI for irrigated conditions in Asia, and RIDEV, a much simpler model developed by AfricaRice simulating phenology of rice and sterility due to heat or cold stress under irrigated conditions in the Sahel.

An improved version, ORZYA2000, was released in 2001 by IRRI, followed by progressive revisions until 2009, but it was based on ORYZA1 and therefore fails to accurately simulate yield under Sahelian conditions.

"We chose to proceed with the 2009 version of ORYZA2000," says Pepijn van Oort, crop modeler at AfricaRice, "because we hope that any improvement in the main model will also be useful under different conditions from those we tested, such as with water or nitrogen limitation, or in crop rotations. With ORYZA_S such applications were not possible."

This meant that 20 years on, there was a need to take a fresh look at phenology and cold and heat stress in the Sahel. Developing new subroutines and other refinements to obtain a better predictive model for rice in the Sahel — in a changed climate with respect to the 1990s — became the new challenge for AfricaRice.

Computer-based models create simplified versions of reality and so should never be considered perfect. "Perfect prediction is suspect, may be caused by over-parameterization on a limited dataset, and runs a risk of adjusting parameter values without sound eco-physiological justification," says van Oort. "We have tried to avoid this by using a large dataset, by making only modifications substantiated by solid experimental research, and by keeping calibration to a minimum."

The large data set was obtained by Michiel de Vries, then AfricaRice irrigated-rice agronomist, from monthly sowings of variety IR64 at two sites in the Senegal River valley over 15 months in 2006–2007, a total of 29 treatments.

The modifications made, chosen on the basis of previous research, comprised: (i) so-called 'cardinal' temperatures (*see* Box 'Cardinal temperatures and the difference between growth and development' for definitions) for development; (ii) cardinal temperatures for early leaf growth; (iii) spikelet-formation process; and (iv) heat- and cold-induced sterility.

The model was specifically calibrated only for developmental characters. Moreover, to test the new heat- and cold-induced sterility subroutines, validation simulations were run to predict yield, first using observed development and number of spikelets, and second with simulated development and number of spikelets.

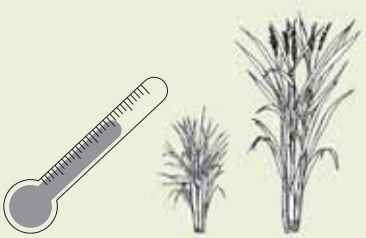
"The first thing we needed to adjust for IR64 grown in the Sahel was the cardinal temperatures," says van Oort. "In particular, IR64 has a much higher base

temperature than the default setting in ORYZA2000 (14°C cf. 8°C), a slightly higher optimum temperature (31°C cf. 30°C), and apparently experiences no delay in development at temperatures above the optimum (i.e. there is no maximum temperature, at least not under the conditions tested)." With these parameters corrected, the model gave improved simulation of rice development and therefore yield.

"We started with the situation in which ORYZA2000 overestimated heat-induced sterility and underestimated cold-induced sterility," says van Oort. "The new heat and cold subroutines give much better simulation of the two sterilities and, consequently, final yield." The keys to improving heat-induced sterility simulation were transpirational cooling and flowering time, while the key to improved cold-induced sterility was using minimum daily temperature rather than average daily temperature. "These modifications are

Cold-induced spikelet sterility (left) compared with normal fertile spikelet (right)

Cardinal temperatures and the difference between growth and development



Cardinal temperatures

Three critical or 'cardinal' temperatures are defined in crop development.

Base temperature is the temperature below which no development occurs.

Optimum temperature is the temperature at which the development rate of a plant is fastest — development of a plant at optimum temperature will occur in the shortest possible time for that particular plant; this may not be the same as optimum temperature for growth.

Maximum temperature is the temperature above which no development will occur.

Growth and development

Growth is simply defined as the accumulation of biomass.

Development is the process of aging; in the modeling described here, crop development is simulated in four stages: emergence, panicle initiation, flowering and maturity.

Thus, a plant does not *develop* — move from one stage to the next — below *base temperature*. For example, if a rice crop is sown or transplanted in an environment below or close to the base temperature, it will simply produce leaves because it *grows* but does not *develop* — it is stuck in the first (vegetative) stage of development. Similarly, if external temperature rises above maximum temperature at a later stage in the crop cycle, heat-induced sterility will result from either panicles failing to attain flowering, or flower-bearing spikes failing to reach maturity.

all logical if we think about where we're working," says van Oort. "ORYZA2000 was developed in and for Southeast Asia which, for the most part, is a humid tropical environment. In comparison, arid regions like the Sahel experience much lower humidity and much greater ranges in daily temperature."

In a dry environment, the relative humidity (RH) is much lower than in a humid one. Thus, the ability of a plant to cool itself through transpiration is much greater in the arid zone (just like humans can sweat to cool themselves in a dry environment, while sweating in a humid environment just makes one wet!). According to the subroutines developed by van Oort, at 35°C and 30% RH (typical of the Sahel), a plant can cool by 6°C relative to the air temperature via transpiration, while at 30°C and 90% RH (typical of humid tropical Southeast Asia), there is zero ability to cool via transpiration.

Flowering earlier in the morning means the rice plants are exposed to a lower temperature, which reduces the risk of heat sterility. In general, rice plants flower earlier during the day in hotter environments, but this characteristic is also genetically controlled and so varies with genotype. "Putting flowering time into the model now allows us to simulate how much yield gain can be obtained from breeding for earlier-flowering varieties," says van Oort.

Arid environments also have much larger temperature differences during the day. "On one day in January, temperature increased from 8°C to 33°C. According to ORYZA2000, the cold-sterility risk was small, because average temperature was 'safe', but it was clear that the minimum of 8°C caused severe cold sterility. We therefore changed the subroutine to use minimum rather than average temperature."

"Model calibration can be a tricky enterprise," says van Oort. "At a certain point we found that the model was overestimating biomass production and therefore also yield. An effective trick to increase accuracy for yield was to modify the parameter that determines the number of spikelets formed per unit of biomass. But this led to unrealistic parameter values, because the real problem was that the model was overestimating total biomass. So we kept focused on the real causes of errors and played no artificial tricks with parameters."

At the end of the day, van Oort and the team were able to modify the ORYZA2000 model to better predict IR64 rice development and yield in the arid Sahel of the Senegal River valley. Moreover, it did a better job of these predictions than the benchmark ORYZA_S that was developed for the same environment and optimized for IR64 in 1999.

"It is important to remember that this work was not done in isolation," says van Oort. "It would not have been possible without the work done in the 1990s by Michael Dingkuhn (formerly with AfricaRice) and his co-workers in developing ORYZA_S and RIDEV." In fact, the Sahel-adapted ORYZA2000 of van Oort and partners uses several equations and parameters derived from ORYZA_S and RIDEV.

"Our results indicate a need for further research into the components we identified, and to re-assess the climate risk to rice in arid regions," concludes van Oort. "Our discoveries about the importance of cardinal temperatures, heat tolerance and heat avoidance also provide a basis for variety selection, as these three critical characteristics are genetically controlled and vary across cultivars."

Breeding for salinity tolerance — the *Saltol* gene

As a rule, rice plants have something of an aversion to salt, so irrigating the crop with saline water is not a good idea. Nonetheless, saline irrigation water is a problem that many coastal and river-mouth farmers have little choice but to live with. AfricaRice is breeding salt-tolerant rice varieties to be grown in salinity-affected areas of irrigated rice production in Mauritania, Senegal and The Gambia, and mangrove areas of countries like Guinea-Bissau and Sierra

Leone. Salinity problems are expected to become more widespread world-wide because of climate change.

"The salinity-tolerance gene *Saltol* has been known for more than two decades, and has been the subject of extensive work by IRRI," says AfricaRice molecular geneticist Kofi Bimpong. "Through the STRASA project funded by the Bill & Melinda Gates Foundation, IRRI shared the genetic sequence of *Saltol* and the donor line FL478 with AfricaRice. Through a combination of conventional and modern breeding, our objective was to put the gene into the most popular and widely-grown varieties — the so-called 'mega-varieties' — from areas that have a salinity problem."

The first two mega-varieties selected were Rassi, popular with farmers in the Gambia River valley in The Gambia and Senegal, and Sahel 108, the dominant variety in the Senegal River valley in both Mauritania and Senegal. The methodology comprised crossing the donor plant (FL478) with the mega-variety, then backcrossing the *Saltol*-bearing progeny to the mega-variety over three generations. Plants carrying the *Saltol* gene were determined by marker-assisted selection (MAS) between each cross.

"After the first backcross of the FL478–Rassi progeny to Rassi, we screened 219 offspring by extracting DNA from early growth leaves," explains Bimpong. "The 64 plants determined to be carrying *Saltol* were allowed to continue to grow, and then backcrossed a second time. For the subsequent generations [known as BC_2F_1 and BC_3F_1], a combination of foreground markers for *Saltol*, two recombinant markers that flank the *Saltol* region to ensure minimum size of the introgression and also to prevent any 'linkage drag', and 151 polymorphic background SSR [simple sequence repeat] markers across the 12 chromosomes of rice were used to ensure minimum donor genome in the progenies."

Card cutouts used in the lab for growing seedlings of parents and progeny for MAS

Bimpong adds: "Through MAS approach we selected 29 and 7 progenies with *Saltol* gene in BC_2F_1 and BC_3F_1, respectively. These were the plants with lowest levels of FL478 background." The final selection of seven plants was allowed to grow and self-pollinate, generating 2380 viable seeds.

These seeds were grown under controlled conditions in the screen-house at a high salinity level (EC = 12 dS/m) alongside FL478 and a saline-sensitive check. "At the point when the check died from salt poisoning, all the other plants were still alive," says Bimpong. These surviving plants were transferred to the field under salt-free conditions to multiply seed for the following stages. In all, 116 progenies were selected under this project.

"*Saltol* imparts tolerance to salinity in the early seedling stage, but many sites in our mandate area have high salinity throughout the season," says Bimpong. He and his team therefore decided to conduct what amounted to a yield trial at two sites in the Senegal River valley. In Ndiaye, plots on AfricaRice Sahel station's main farm were irrigated with non-saline water (EC < 2 dS/m), while others were cultivated in Ndiol, a salinity hot spot, with typically high salt levels (EC ≥ 6 dS/m).

Bimpong notes: "To ensure severe screening conditions, we monitored the water at Ndiol and kept it at an EC of 6 dS/m or above by adding common salt when necessary."

Sample genotypes of Saltol *introgression lines of Rassi. Key: blue = introgressed genes from FL478; red = Rassi genes; gray = heterozygous loci (genes from both parents). Note the uniform introgression of* Saltol *on chromosome 1 and the large amount of FL478 genetic material on chromosome 10*

Screening for tolerance to salinity

Screening under non-saline conditions

More than a quarter of the lines tested suffered no more than 26% yield reduction in the salt-stressed environment, and some as little as 3% — they also had good agronomic characteristics. The implication is that these lines also have a measure of tolerance to salinity throughout the growth cycle, not just the early seedling tolerance imparted by *Saltol*.

"Consequently, we set about searching for QTLs [qualitative trait loci] that seem to enhance the activity of *Saltol* beyond the early seedling stage," says Bimpong. The team located three QTLs of interest, all from FL478 and all on chromosome 10: one each for grain yield, number of panicles per square-meter and number of grains per panicle. "These QTLs will be used to maintain season-long salinity tolerance in the coming generations," Bimpong concludes.

In 2013, Bimpong grew fixed lines in the field in the form of BC_3F_6 plants that looked good and performed well under salinity stress. And these were not just from the FL478 × Rassi cross, but also from the FL478 × Sahel 108 cross. "We have proposed 50 of these lines from the two families to the Africa-wide Rice Breeding Task Force Multi-Environment Trial," says Bimpong, "and are in the process of multiplying seed for that wide-scale testing."

Kofi Bimpong examines his 'babies' that are carrying the Saltol *gene in the field*

First fruits of the Africa-wide Rice Breeding Task Force: ARICA

In 2010, AfricaRice and national and international partners launched an Africa-wide Rice Breeding Task Force, responding to a call voiced by the participants of the Second Africa Rice Congress held in Bamako, Mali. The main objective of the task force is to systematically evaluate promising breeding lines from AfricaRice and other institutions (working at national or international level) across the continent, spot champions early through detailed genotype-by-environment (G×E) analyses, and stimulate varietal release in Africa in general. The Breeding Task Force comprises international and national rice breeders from 30 African countries.

In 2013, the first varieties to emerge from the Africa-wide Rice Breeding Task Force were named *A*dvanced *Ric*e for *A*frica, or ARICA for short.

"The vote on what breeding line was good enough to become part of the 'NERICA' or NERICA-L family was a completely AfricaRice affair in the past, although the majority were developed in partnership with NARS and IRRI," says Moussa Sié, AfricaRice senior breeder and coordinator of the Africa-wide Rice Breeding Task Force. "With the task force, breeding lines that 'survive' the screening across sites and seasons are discussed among all members and then eventually may be named ARICAs."

Sié adds: "These breeding lines can come from anywhere, from a NARS, CIAT, CIRAD [Centre de coopération internationale en recherche agronomique pour le développement], AfricaRice or through collaborative work between institutions. An ARICA is, therefore, truly a joint product, a quality label we can all be proud of. Our NARS colleagues truly appreciate this change."

The task force has become quite an undertaking: in 2013, breeders used 160 sites covering 5 rice-growing environments in 29 countries!

Ripe panicle of ARICA 4

The criterion for a rice to become an ARICA is simple: it must consistently out-perform the best checks in at least one site over at least three seasons. In other words, it must represent significant improvement on the current best variety.

However, the task force has stipulated that this out-performance (e.g. in terms of yield or tolerance to a biotic or abiotic stress) must be backed by concrete data from at least three trials at the target release site. That means lots of trials and even more data, all of which must be statistically analyzed.

"The first stage," explains AfricaRice biometrician Ibnou Dieng, "was to develop a standardized experimental methodology, known as the 'experimental protocol'. We did this in 2010 with the breeders from the NARS in the task force.

This standardized protocol enables us to analyze the data across sites and countries with confidence, knowing that the same practices have been followed at all sites." Moreover, the task force members agreed on a common set of plant traits to be measured in each of the trials.

After the 2011 season, Dieng and others realized that the steps in the selection process were overly demanding on NARS and AfricaRice resources, so they redefined the process as outlined below.

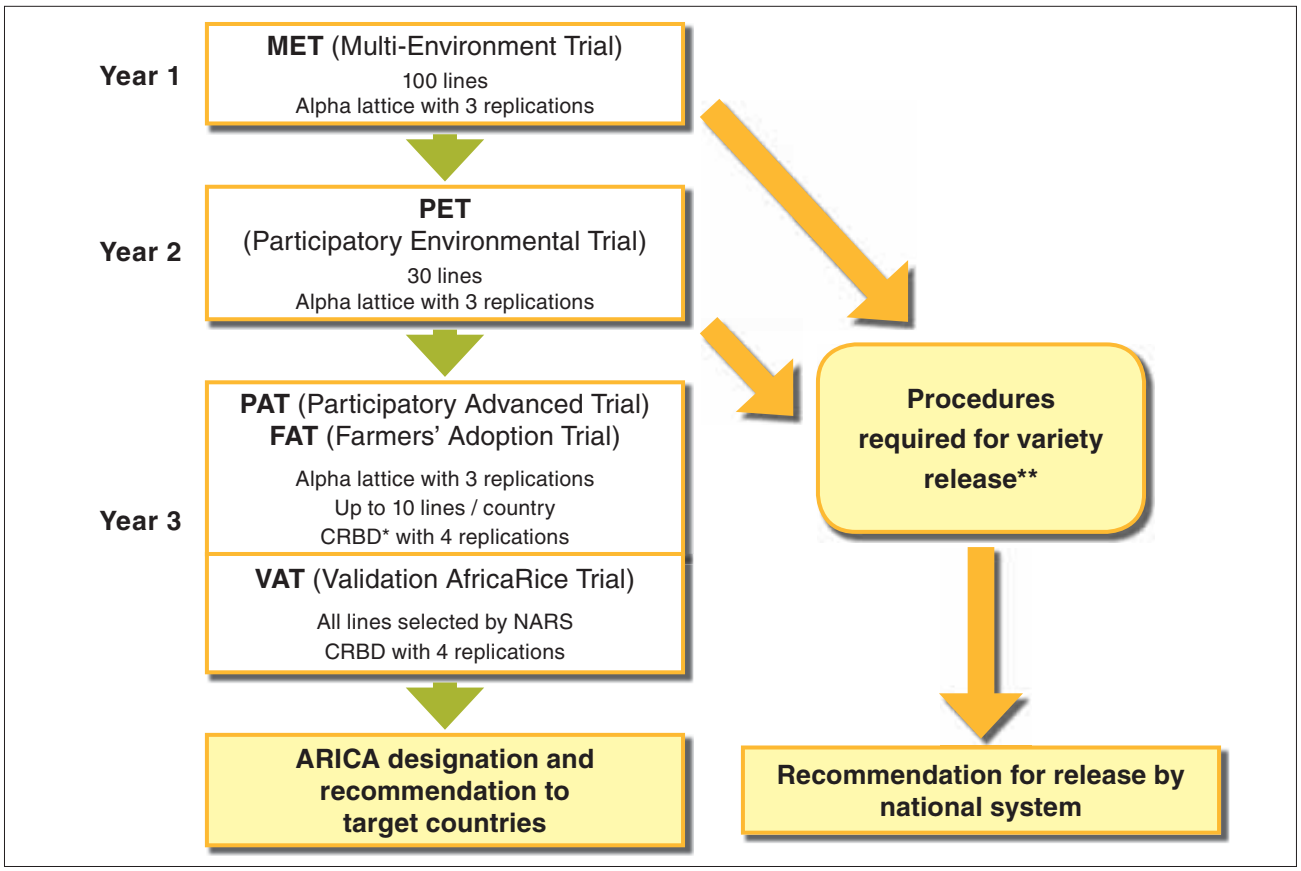
In the first year, the task force provides seed of up to 100 breeding lines per rice-growing environment for the Multi-Environment Trial (MET) conducted at one site (per rice-growing environment) in each country. These breeding lines come from the partners of the GRiSP, namely AfricaRice, IRRI, CIAT, CIRAD, IRD, JIRCAS and the African NARS themselves.

The MET is overseen by the national rice breeder for the particular rice-growing environment. When all the data are gathered in, AfricaRice performs a global analysis per environment across sites (i.e. a G×E analysis). "What we are looking for is varieties that perform consistently well across sites and others that perform consistently well within one or a few sites in terms of yield," says Dieng.

In the second year, a Participatory Environmental Trial (PET) is composed from the best 30 lines from the MET, comprising both broadly adapted and site-specific lines. Again, however, this is a single set sent to each country (i.e. each country grows the same lines).

The PET is a trial that combines traditional breeder selection and participatory varietal selection (PVS). The PVS element involves visits from farmers, other rice stakeholders and the national varietal release committee to provide their opinions on the materials. The outcome is the best 10 candidate varieties *per rice-growing environment per country.*

The third year involves two or three sets of trials run in parallel. One is the Participatory Advanced Trial (PAT). It helps generate sufficient data for statistical purposes. The second is the Farmers'



*Schematic of the 'three steps' for ARICA designation as adopted by the Africa-wide Rice Breeding Task Force in 2012 (*CRBD, completely randomized block design. **Countries have the option to fast-track varieties for release from their selections in MET and PET).*

Adoption Trial (FAT) in which the NARS distributes two or three of the candidate varieties from PET to farmers to be grown within their own farming systems and tested against their local varieties. Ideally, the FAT involves 50 farmers per country.

The end result is that each candidate variety is tested by a number of farmers in the appropriate rice-growing environment across the country. At the end of the third year, adding the data from PAT and farmers' feedback from the FAT to the data from MET and PET, each NARS can select the best breeding lines to put forward for release in the country. Upon notification from a NARS, all data stored in the global database at AfricaRice are checked. When supporting data are confirmed, ARICA designation is recommended to a meeting of the task force, which then approves it.

In the Validation AfricaRice Trial (VAT), the NARS-selected candidates are grown at AfricaRice under the supervision of an agronomist. The main purpose of this trial is to generate the 'passport data' (i.e. detailed agronomic characteristics) required by the national varietal release systems. The VAT can be run in parallel with the PAT and FAT, so the whole process can take as little as 3 years.

In the wet season of 2012, eight breeding lines were subjected to VAT at both Cotonou (Benin) and Ibadan (Nigeria) alongside four checks. "For agronomic traits, the 2012 VAT covered paddy yield, number of panicles, number of spikelets, days to heading and plant height," says AfricaRice agronomist Kazuki Saito. "In terms of all these traits and averaged across the two sites, ARICA 2 and ARICA 3 were very similar to the best check, WITA 4, except that ARICA 2 had a 10% yield advantage over, and was a little taller than, WITA 4."

The second aspect of the VAT is the postharvest properties of the grain. "ARICA 2 and ARICA 3 were the top candidates among the eight tested," says AfricaRice grain-quality specialist John Manful. "Both were very similar to our best check, WITA 4, in terms of milling recovery and head-rice yield, all three in the category of 'very good'." The two ARICAs were slightly better than WITA 4 in terms of chalkiness, both rating 'Grade 1' (2.1–5% chalkiness) compared to WITA 4's 'Grade 2' (5.1–10%). "Given that the level of chalkiness is strongly influenced by the temperature at grain-filling stage, 5% chalkiness is probably close to the best we can expect in tropical Africa," says Manful.

"Our second-best check for the rainfed lowland is the much newer NERICA-L 19," says Manful. "This variety is very close to WITA 4 agronomically and differs mainly in its chalkiness. Thus, the two ARICAs plus WITA 4 outperformed NERICA-L 19 in terms of chalkiness."

"The important aspect of the ARICA-designation process is the quality assurance," says Takashi Kumashiro, leader of the AfricaRice Genetic Diversity and Improvement Program. "Breeders' assessments of the material are backed by hard data collected over a number of years. We are no longer promoting varieties on the basis of the breeder's say-so alone, but on field data."

Consequently, in 2013 five varieties were designated as ARICA 1 through ARICA 5. These first fruits of the task force's work were identified as suitable for cultivation in the rainfed lowlands of Burkina Faso, Mali, Nigeria and Togo (ARICA 1, ARICA 2, ARICA 3) and the uplands of Uganda (ARICA 4, ARICA 5) — *see* Table 1 for details (pages 36–37). ARICA 1 has already been released in Burkina Faso and ARICAs 4 and 5 in Uganda.

"One of the main objectives of the Breeding Task Force is to stimulate and accelerate varietal release in the target countries," says Kumashiro. It seems fair to say that this goal has been achieved, at least in the short term.

ARICA 3 seed produced at AfricaRice M'bé station, Côte d'Ivoire

Table 1. Yield performance of the first five ARICA varieties

ARICA 1

Country	Site	Year	Yield (kg/ha)		Check variety
			ARICA 1	Best check	
Burkina Faso	Banfora	2011	1802	1508	NERICA-L 19
	Banfora	2012	3209	2236	NERICA-L 19
Mali	Niono	2010	6005	4560	BW348-1
	Sikasso	2010	3458	2958	BW348-1
	Sikasso	2012	5676	4891	WITA 12

ARICA 2

Country	Site	Year	Yield (kg/ha)		Check variety
			ARICA 2	Best check	
Mali	Niono	2010	6674	4560	BW348-1
	Sikasso	2011	2781	1857	NERICA-L 19
	Sikasso	2012	5133	4891	WITA 12
	Niono	2013	8212	6944	KOGONI 91-1
Nigeria	Edozhigi	2010	1924	1634	BW348-1
	Edozhigi	2011	1147	543	NERICA-L 19

ARICA 3

Country	Site	Year	Yield (kg/ha)		Check variety
			ARICA 3	Best check	
Burkina Faso	Banfora	2011	1543	1508	NERICA-L 19
	Banfora	2012	2387	2236	NERICA-L 19
Mali	Niono	2010	5490	4560	BW348-1
	Sikasso	2010	3250	2958	BW348-1
	Sikasso	2011	3140	1857	NERICA-L 19
	Sikasso	2012	5314	4891	WITA 12
	Niono	2013	9565	6944	KOGONI 91-1
Nigeria	Badeggi	2012	7445	5221	NERICA-L 19
Togo	Kpalime	2010	2632	1923	BW348-1
	Adeta	2013	6689	5911	WITA 4
	One	2013	4351	4319	WITA 4
Côte d'Ivoire	Gagnoa	2012	5160	3940	WITA 9
	Gagnoa	2013	5290	4783	NERICA-L 16
	Man	2013	2073	1990	WITA 9
Ghana	Kumasi	2011	5930	5864	WITA 4
	Nobewan	2013	4452	3718	IR841
	Nyankpala	2013	4982	4576	IR841

Table 1. Yield performance of the first five ARICA varieties (*Continued*)

Country	Site	Year	Yield (kg/ha)		Check variety
			ARICA 4	Best check	
Uganda	Kanungu	2011	3400	3028	NERICA 4
		2012A	3677	3344	
		2012B	3855	3480	
	Kibaale	2011	2994	2463	
		2012A	3144	2679	
		2012B	3225	2715	
	Soroti	2011	3162	2866	
		2012A	3305	2966	
		2012B	3187	2886	
	Masindi	2011	3062	2766	
		2012A	3241	2966	
		2012B	3351	2986	
	Namlonge	2011	2884	2533	
		2012A	3045	2688	
		2012B	3140	2738	
	Aura	2011	3637	2893	
		2012A	3668	2928	
		2012B	3663	2918	

ARICA 4

Country	Site	Year	Yield (kg/ha)		Check variety
			ARICA 5	Best check	
Uganda	Kanungu	2011	3434	3028	NERICA 4
		2012A	3706	3344	
		2012B	3879	3480	
	Kibaale	2011	2659	2463	
		2012A	2835	2679	
		2012B	2912	2715	
	Soroti	2011	3309	2866	
		2012A	3397	2966	
		2012B	3386	2886	
	Masindi	2011	3209	2766	
		2012A	3397	2966	
		2012B	3486	2986	
	Namlonge	2011	2881	2533	
		2012A	3062	2688	
		2012B	3135	2738	
	Aura	2011	2741	2893	
		2012A	2763	2928	
		2012B	2737	2918	

ARICA 5

Donor profile – Japan

Japan's enduring strategic partnership with the Africa Rice Center (AfricaRice) has made it a leading supporter of rice research for development in Africa for more than three decades. Japan and AfricaRice have worked together with national partners across the continent to enhance rice quality and productivity, reduce producer and consumer risks, and increase farmers' incomes through more productive and sustainable rice farming systems.

Rice varieties: 'Old' and new

From the mid-1990s though the first decade of the 2000s, the flagship of AfricaRice varietal development was the interspecific crosses work that led to the upland NERICA and lowland NERICA-L families of varieties.

This work was strongly supported by Japan, both directly through the Ministry of Foreign Affairs (MOFA) and indirectly through the United Nations Development Programme's Technical Cooperation among Developing Countries, both of which funded the Interspecific Hybridization Project (IHP). The project bore much fruit, including the recognition of the 18 NERICA and 60 NERICA-L varieties, most of which have now been released in at least one country in sub-Saharan Africa.

NERICA 1 was one of the first seven upland interspecific varieties to be named back in 2000

NERICA's impact in seven West African countries was assessed through the 5-year Multinational NERICA Rice Dissemination Project, supported by the AfDB, EU and Japan, and implemented by the African Rice Initiative (ARI). In 2011, farmers who had participated in the project benefited from additional income of US$ 14.4 million, while the spin off to non-participant farmers was estimated at $28.7 million — a total of $43.1 million. By the end of the project, more than 35,000 people living in participating rice-farming households had been lifted above a $1.25 per day poverty line.

A conservative estimate of NERICA production in sub-Saharan Africa in 2011 was 700,000 ha, nearly 200,000 ha of which was NERICA 1 and 2 grown in Nigeria. In Uganda, where 35,000 ha of NERICA varieties were grown in 2007 alone, the country was able to halve its imports of rice in the 5 years from 2002 to 2007, saving about $30 million in foreign exchange earnings. Similar successes were reported in other countries, such as Burkina Faso, Ethiopia, Guinea, Mali, Sierra Leone and Togo.

In 2010, a new project was initiated with support from Japan's Ministry of Finance to accelerate the development and deployment of the next generation of elite rice varieties for major production systems in

Old friend and supporter of the IHP, Ken Tatsuo Fujimura has been 'with' us since the early days of interspecific crossing, here seen with former AfricaRice Director General Papa Seck

sub-Saharan Africa and Southeast Asia, where poverty is prevalent and the risk of food shortage is high.

As part of this, the Africa-wide Rice Breeding Task Force was launched to accelerate the development of rice varieties through continent-wide varietal evaluation of nominated elite lines from AfricaRice and international and national partners. The task force is also helping build much-needed rice breeding capacity, facilitating access for African rice breeders to new materials, and generally shortening the time needed to deploy new climate-resilient and stress-resistant rice varieties for major production systems in Africa.

During its April 2013 meeting, the task force identified five such varieties, which became the first set of ARICA varieties (*see* 'First fruits of the Africa-wide Rice Breeding Task Force: ARICA', page 32), three of which have interspecific parentage and came through the IHP (at least in part).

Valuable genes

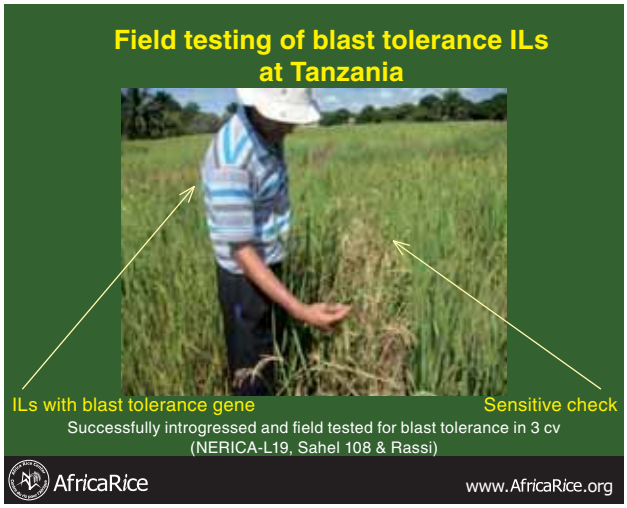
In modern crop breeding, genes are the all-important resource. In 2010, agricultural research institutes in Japan (National Institute of Agrobiological Sciences, NIAS; National Agriculture and Food Research Organization, NARO; and Japan International Research Center for Agricultural Sciences, JIRCAS) shared a number of cloned genes with AfricaRice to promote three aspects of our breeding work: blast resistance, cold tolerance and non-shattering. These genes have been placed in the capable hands of AfricaRice Molecular Geneticist Kofi Bimpong.

"We received [separate] donors for two genes and marker information for blast resistance from NIAS," says Bimpong. "The recessive *pi21*, which acts at early seedling stage to prevent leaf blast, and the dominant *Pb1*, which acts at panicle initiation to prevent panicle blast.

"We have initiated MAS programs to introgress these genes into five popular lowland/irrigated varieties, namely NERICA-L 19, Sahel 108, Rassi, BG90-2 and Kongoni 90-1." To date, the work has involved crosses designed to create versions of the popular varieties with one of the blast-resistance genes — for example, NERICA-L 19 with *pi21*, NERICA-L 19 with *Pb1*. At a later stage, further crossing should enable us to combine the two genes in modified versions of the popular varieties (e.g. NERICA-L 19 with both *pi21* and *Pb1*).

"In 2013, we had BC_1F_2 materials in the field at Kyela, a blast hot spot in Tanzania, and in the screen-house in Cotonou, Benin," says Bimpong. "These showed good resistance, and 26 *Pb1*-derived lines were resistant to blast throughout their lives, from seedling to maturity."

Moreover, six *pi21*-derived lines were also resistant to blast throughout the growth cycle. This may seem unusual until one remembers that blast is a highly complex disease with numerous 'pathotypes', each of which is resisted by a single rice gene.



NIAS has also shared marker information on the cold-tolerance donor Suito ChuukanBohon Nou 11 (abbreviated as Suito 11) with AfricaRice. The gene is being introgressed by MAS into Sahel 108, NERICA-L 19 and BG90-2, all popular varieties in Senegal, Mali and Mauritania. In this case, the screening is being conducted in a cold room in Tanzania and in the field in the Senegal River valley, Senegal during the cold *harmattan* season of November to February/March. Some 15 cold-tolerant lines were identified in the field from the three crosses, which will be progressed through BC_2F_2 and BC_1F_3 in 2014.

'Shattering' is the propensity of the rice head to shed its grains before or during harvesting and threshing, especially when these processes are mechanized, a practice that has become common in the Sahel. "Shattering poses major logistical problems for us," says Bimpong. "JIRCAS has shared two genes with us (*SR-1* and *SR-5*)." To test shattering, one research assistant has been holding the panicles and applying approximately the same force each time! The selection for non-shattering involving crosses with varieties such as Sahel 159 and Sahel 317 has reached its second round of MAS with seeds from F_4, BC_1F_3 and BC_2F_2 generations.

Plant diseases

For several years, Japan has been funding some of AfricaRice's work on plant diseases. This has included surveys to increase our knowledge of the epidemiology of *Rice yellow mottle virus* (RYMV), as well as the disease's distribution and importance in West Africa. Another goal of the work is to identify rice lines with durable resistance to RYMV.

"We have also been screening the AfricaRice collection of *Oryza glaberrima* and AfricaRice varieties for RYMV resistance," says AfricaRice plant pathologist Drissa Silué. "The second RYMV resistance gene, *RYMV2*, was identified from *O. glaberrima* within this project in collaboration with IRD, France. Ideally we want to screen the proposed *parent lines* to be used in crosses before the breeders actually make the crosses."

One of the problems encountered was determining which isolates of the virus to use in screening the rice lines. "We have over a thousand isolates," says Silué, "and we have genetically sequenced some to create a diversity tree. Using this tree, we can select one isolate from each grouping to represent the diversity with a small number of isolates." AfricaRice now has a core set of isolates for RYMV resistance screening, and a biosafety level-three screen-house for isolates from outside of Benin that need to be contained.

"We have determined that there is just one pathotype of RYMV in Benin — hence the need to prevent introduced isolates from escaping into the wild," says Silué. "However, there are already resistance-breaking isolates emerging in Benin."

One potentially risky aspect of the research is trying to determine how many generations it takes for RYMV to break a newly introduced resistance. "With only five resistance sources available, and four of those occurring at one locus, we have limited material to work with," says Silué. The project has been testing varieties that combine *RYMV1* allele (*rymv 1-2* or *rymv1-3*, also identified by IRD and AfricaRice) and *RYMV2*.

*The blast causal agent (*Magnaporthe oryzae*) infects the leaves, nodes and neck of the rice plant. In neck blast (illustrated here) the point of attachment of the flower- and seed-bearing panicle is weakened almost to breaking point, severely limiting the maturation of grains*

In parallel to the marker-assisted introgression of blast field resistance genes, *Pb1* and *pi21*, JIRCAS and AfricaRice have been collaborating in an area of diversity analysis of blast isolates in Africa. The essence of this collaborative project is to use a set of differential varieties each of which carries a single race-specific resistance gene. Large numbers of blast isolates collected in Africa are being inoculated into the differential varieties. The reaction of the differential varieties identifies the pathotype of an isolate. Overall, the results indicate the prevalence of each pathotype. This information can be used to develop breeding strategies in and for specific regions of Africa.

Closing yield gaps

Rice yields in farmers' fields are still far below what would be possible with improved management. The Africa-wide Rice Agronomy Task Force serves as a platform for enhancing productivity in rice-based systems through the introduction of good agricultural practices (GAP). As part of this task force, AfricaRice agronomist Kazuki Saito has developed the protocols for analyzing yield gaps and their determinants in rainfed and irrigated rice-growing environments that are currently being used by national research institutions in 15 sub-Saharan African countries. He has also trained national partners in this field. (*See* 'Africa-wide Rice Agronomy Task Force', *AfricaRice Annual Report* 2012, pages 4–8, for more information on the Agronomy Task Force.)

Kazuki Saito (right) and colleagues testing a smartphone application for Africa-wide Agronomy Task Force fieldwork

SMART inland valleys

As part of the project 'Sawah, Market Access and Rice Technologies for Inland Valleys' (SMART-IV) — supported by the Japanese Ministry of Agriculture, Forestry and Fisheries (MAFF) — improved land development mainly for water control has been introduced in Benin and Togo in close association with farmers, and has shown promising results. For example, at one site in Benin, farmers more than quadrupled their rice yields in the lowland improved by the SMART-valleys approach (*see* 'Working with farmers to improve water control in inland valleys', *AfricaRice Annual Report 2012*, pages 14–16, for more information on this project). Spillover effects of the project have been seen around the project

demonstration sites in both countries. When they saw what was happening at the sites, NGO and farmers' groups independently developed lowlands using the SMART-valleys approach around the sites without any financial support from the project. This proves the high scalability of this approach.

Inland valleys hold the potential for Africa to become self-sufficient in rice

Addressing the rice crisis in Africa

In response to the rice crisis in 2007–2008, MOFA funded a short, sharp one-year project, 'Improving access to rice seed and building a rice data system for sub-Saharan Africa' (also known as the 'Emergency Rice Project'). Carried out in 2009–10, the project aimed to improve farmers' access to rice seed in 20 CARD member countries and build a rice data system for the continent. It was implemented by AfricaRice and over 70 partners, which included national programs, seed companies, agro-dealers and NGOs. It strengthened formal seed systems, providing more than 58,000 vulnerable farmers with quality rice seed, and provided direct training in quality seed production to more than 560 technicians and extension workers — including 190 women — who in turn trained a further 14,000 farmers.

Detailed rice statistics and information on nationally representative samples were collected for the first time by agricultural research systems and statistical services in the project countries. These rice statistics are critical for high-quality research and evidence-based policy formulation, and will provide a solid basis for analyzing future trends in rice production.

However, the high price of food continues to be a problem. In 2012, a number of sub-Saharan African countries suffered from unexpected climate-related damage in the form of both droughts and floods. MOFA is supporting a new Rice Emergency Initiative, implemented via the rice-sector development hub mechanism in 27 sub-Saharan African countries, to improve farmers' access to quality seed and small-scale machinery (for more information on the rice-sector development hubs, *see* 'Africa-wide Rice Agronomy Task Force', *AfricaRice Annual Report 2012*, pages 4–8). Some 286 seed producers, farmers and extension personnel were trained in rice seed production. The goal is to provide 60 t of seed for each project country. To date, some 80–90% of the planned volume of seed has been produced and is being collected and bagged for distribution. Project farmers will be given vouchers to exchange for seed.

The situation in Niger is that flooding wiped out both the food and seed crops of rice in 2012 and 2013. The seed program consequently sourced 45 t of seed from a seed-producers' organization in an unaffected part of the country to supply the affected farmers.

"The [project] countries have each adopted one of three different strategies for seed production," says Kabirou N'Diaye, leader of the AfricaRice Rice Sector Development Program. "Some, like Senegal, have contracted with commercial seed producers, thereby encouraging the seed industry. Others have developed agreements with individual seed producers or with farmer associations, with the national program providing seed and inputs and the project benefiting from the seed produced. We wait to see which of these three systems works best in the hubs."

After reviewing the hubs' requests for machinery and the available budget, the project decided to buy two 'kits' per country (four for Mali, in an effort to rebuild physical capacity in light of the socio-political crisis in the country). Each kit comprises a power-tiller with attachments, a reaper, a thresher and a small-scale rice mill. Equipment is scheduled to be dispatched in 2014. Some of the threshers are being built in Senegal (for Senegal and Guinea-Bissau), Mali (for Mali, Guinea and Niger), Côte d'Ivoire (for Côte d'Ivoire) and Chad (for Chad, Central African Republic, Democratic Republic of Congo and Sudan). Agreement has been reached with a regional transport company to carry the machines to their destinations. When the machines (both locally fabricated and imported) are delivered, hub members — both farmers and extension staff — will be trained in their use and maintenance.

"Managing the equipment is going to be a major challenge," says N'Diaye. "Currently, the people in the hubs do not work together, so the question is: Can we develop service providers at the hub level? If we can, then we can provide the machinery 'kits' to groups that will then serve their communities."

AfricaRice will also provide training in integrated rice management (IRM) for extension personnel starting in May 2014 to take advantage of its new Regional Training Facility in northern Senegal.

Improving food security information in Africa

The 3-year project 'Improving food security information in Africa' was launched in 2013 with financial and technical support from MAFF. Its goal is to support CARD by improving the availability and reliability of information about rice in Africa through developing and applying a standard survey methodology and building the capacity of NARS staff to use it.

Prior to the official launch of the project, AfricaRice worked with country focal persons to identify current survey methods used in each country and subjected these to technical review. At the same time, it reviewed Emergency Rice Project data-collection and data-processing methods to identify shortcomings in the methodologies and identify data-quality indicators. In putting these together, the project identified key indicators to be included in a standardized survey to collect high-quality production data.

After evaluating advanced survey methods, AfricaRice and MAFF developed improved and harmonized data-collection methods, which were 'published' in

Consultant Issei Jinguji (front left) showing NARS trainees how to identify selected dots on the field using Google Earth

the form of a *Technical Manual for the Pilot Survey in 2013/14*. The methods involve 'dot sampling using Google Earth' and 'crop cutting' to estimate total planted area and yield at a large scale (e.g. national level). The survey was piloted in Madagascar, Nigeria and Senegal in 2013, and will be further piloted in 2014 (Burkina Faso, Sierra Leone, Uganda) and 2015 (Benin, Ethiopia, Guinea). The feedback and results from these pilots will be used to modify the methodology for future surveys — to improve the quality of the collected data and statistical indicators.

Training in the administration of the standardized survey, automation of data collection using Mlax survey application, and data analysis was provided at the project inception workshop and at another meeting in July 2013. In-country training was also conducted in two pilot countries (Nigeria and Senegal). An in-depth training workshop will be conducted each year to train two participants (one agro-economist and one agricultural statistician) per country.

Capacity-strengthening

Strengthening capacity of national partners is central to the AfricaRice–Japan partnership. Many scientists and technicians selected from African national programs have greatly benefited from the Japan Capacity Building Program for African Agricultural Researchers, supported by MAFF. JICA has also enhanced the capacity of African technicians and extension agents in high-quality seed production and supported hands-on training on the fundamentals of field experiments on rice.

Several degree candidates (PhD, MSc) and non-degree trainees from the region have studied under the supervision of AfricaRice scientists and their partners. The Center has also benefited from Japan's Young Scientist Fellowship Program, which enables Japanese scientists to work at CGIAR Centers. AfricaRice research assistants have received technical training in several agricultural research institutes in Japan with support from JICA.

TICAD V

Since it was first held in 1993, the Tokyo International Conference on African Development (TICAD) has promoted high-level policy dialogue between African leaders and their partners, and mobilized support for African-owned development initiatives. TICAD I vowed to reverse the decline in development assistance for Africa which had followed the end of the Cold War, and adopted the Tokyo Declaration on African Development. This commitment to the pursuit of political and economic reforms in Africa included a focus on increased private-sector development, regional cooperation and integration, and the harnessing of Asian experience for the benefit of African development.

AfricaRice has been involved with TICAD since about 2000, and TICAD counts NERICA as one of 'its' success stories (*see* http://www.mofa.go.jp/region/africa/nerica.pdf).

TICAD V (Yokohama, Japan, 1–3 June 2013) brought together the heads of state and government, and delegations from Japan and 51 African countries. There were also representatives of 35 other partner countries, 74 international and regional organizations from both Africa and Asia, the private sector and civil society. This ensemble included a delegation from AfricaRice comprising the director general, deputy director general, AfricaRice's two Japanese program leaders (*see below*) and the head of marketing and communication. The Conference confirmed its ongoing commitment to African development by issuing the Yokohama Declaration 'Hand in Hand with a More Dynamic Africa' and in the Yokohama Action Plan 2013–2017. In particular, TICAD will seek to strengthen cooperation with both the G8 and the G20. In recognition of the African Union Commission's status as co-organizer of TICAD, the African Union will play a greater role in the TICAD process. (*See* 'Major events', pages 50–66, for further details of the AfricaRice delegation's activities around the TICAD V gathering.)

Board members, staff and secondees

Since 1989, five AfricaRice Board members have been Japanese. The most recent of these are Kiyoaki Maruyama, Vice President of NARO, who served 2007–2011, and Masaru Iwanaga, President of JIRCAS, who has been serving since 2011.

Many Japanese scientists have also worked at AfricaRice. Until 1997, these were always on secondment from JICA; however, the arrival of Koichi Futakuchi in 1997 began a wave of Japanese staff directly employed by AfricaRice.

Futakuchi is currently leader of the Sustainable Productivity Enhancement Program. Takashi Kumashiro joined AfricaRice in 2010 as leader of the Genetic Diversity and Improvement Program.

Kazuki Saito joined the Center in 2005 as agrophysiologist and is currently rice agronomist.

Susumu Abe was soil scientist from 2008 to 2013.

Yoshiko Saigenji was socio-economist from 2010 to 2011.

And the latest addition to the 'family' is Atsuko Tanaka, who joined as postdoctoral fellow in soil science in 2013.

Although the Center now employs Japanese scientists directly, it also continues to host others seconded from JICA and JIRCAS. A list of JICA and JIRCAS scientists who have worked at the Center since 2008 is given in Table 1 (secondees up to 2008 are listed in an earlier donor profile of Japan in the annual report for 2008).

"We have enjoyed a long and fruitful relationship with Japan," says AfricaRice Deputy Director General Marco Wopereis. "Put simply, we would not be where we are today without them. It was Japan that supported our work on the NERICA varieties and our Japanese partners continue to put faith in our work. We are very grateful. And long may it continue."

Table 1. List of JICA and JIRCAS staff based at AfricaRice, 2008–2013

Name	Affiliation	Position	Dates
Hiroshi Tsunematsu	JIRCAS	Geneticist	2001–2002, 2004–2009
Yoshimi Sokei	JICA	Agronomist	2004–2011
Ryoichi Ikeda	JICA	Seed specialist	2005–2009
Tadashi Takita	JICA	Seed specialist	2009–2011

Faces old and new (clockwise from top left): Ryoichi Ikeda, JICA seed specialist (2005–2009); Masaru Iwanaga, Board member (2011–); Takeshi Kumashiro, Genetic Diversity and Improvement Program leader (2010–); Yoshimi Sokei, JICA agronomist (2004–2011); and (center) Atsuko Tanaka, PDF soil scientist (2013–)

Atugonza L. Bilaro

Atugonza L. Bilaro is a plant breeder working with Tumbi Research Institute in western Tanzania, one of the agricultural research institutes under the Ministry of Agriculture, Food Security and Cooperatives (MAFSC). He started his PhD studies in 2013 at Sokoine University of Agriculture (SUA) on 'Genetic improvement of rice (*Oryza sativa*) for tolerance to phosphorus deficiency in Tanzania'. His study is supported by MAFSC and AfricaRice through the Japan Rice Breeding Project.

Low soil phosphorus (P) limits rice production in many parts of the world. In some rice production areas in Tanzania, there is little soil P available to plants. Moreover, the majority of Tanzanian smallholder rice farmers apply very little or no fertilizer — cost is likely to be a factor for most. One of the solutions to manage low available P is to develop rice varieties that can tolerate P deficiency, to ensure that smallholders achieve relatively high yields in P-deficient areas without incurring the additional cost of fertilizer. Bilaro's study aims to improve the P-deficiency tolerance of the local and improved rice varieties that are grown widely in East and Southern Africa.

In 2013, Bilaro screened 96 farmer-grown rice varieties from Malawi, Mozambique and Tanzania, plus 4 varieties from IRRI as checks. The screening was undertaken at Dakawa (irrigated lowland), in Morogoro region, Tanzania, using two treatment groups: one that received the full dose of fertilizers (with-P) and one that received the full dose of all fertilizers except for P (without-P). The same 100 varieties were also evaluated in a pot experiment at SUA. Soil analysis showed that both field and pot soils had sub-optimal levels of available P: 10.6 ppm and 5 ppm, respectively.

"The severity of P deficiency was clearly demonstrated in the field and in the pot experiment," says Bilaro, "especially in leaf production, what we call 'tillering'. The average across the 100 varieties was a reduction by over half of tillering in the field and by three-quarters in pots. Plants in both trials also exhibited another classic P-deficiency symptom: dark green leaves." Time to flowering, shoot biomass and grain yield were also affected, but not to the same extent. Average grain yield was reduced by only 2% in the field but 31% in pots compared to the with-P controls. "This difference may have been due to the relatively higher level of available P in the field experiment compared to that in the pot experiment and also to better control of nutrient supply in the pots," explains Bilaro.

"So far, *phosphorus uptake 1* (*Pup1*) is the only QTL for P-deficiency tolerance that is ready for use in breeding programs," says Bilaro. Previous studies have shown that the major determinant of *Pup1* effect in P-deficient conditions (that is, greater P uptake) is the *phosphorus starvation tolerance 1* (*PSTOL1*) gene (which effects increased root growth); specific markers targeting two different alleles of *PSTOL1* (from Kasalath, the tolerant donor, and CG14, an *Oryza glaberrima* variety) are available. Genotyping of 93

of Bilaro's varieties with these *PSTOL1* markers and the 4 checks revealed the presence of Kasalath and CG14 allele in 49.4% and 9.6%, respectively (one had both alleles). The rest of the collection (41%) does not have *PSTOL1*.

"Not all varieties carrying *PSTOL1* were among the top performers without P fertilization in our field and pot trials," says K. Nani Dramé, AfricaRice molecular biologist and one of Bilaro's supervisors. It has been hypothesized that the expression of *PSTOL1* may be specific to a certain genetic background or environment.

For the second-season evaluation in the field at Dakawa, 20 of the 100 varieties have been selected. These are: (1) varieties with *PSTOL1* and above-average yield in both with- and without-P plots; (2) varieties without *PSTOL1* but with above-average yield in both with- and without-P plots, indicating that they carry other genes/QTLs for P-deficiency tolerance; and (3) varieties without *PSTOL1* with above-average yield in with-P plots but below-average yield in without-P plots. "The selection of these 20 varieties also took account of other traits such as grain quality, non-lodging and non-shattering," says Bilaro.

From this second-season trial and P-content analysis of the tissues, confirmed tolerant varieties from groups 1 and 2 will be used as donors in the next steps of Bilaro's doctoral studies, and they may also be immediately recommended for use in P-deficient soils without awaiting further results. One of the next steps in Bilaro's study will be the improvement of selected varieties from group 3 to achieve better P-deficiency tolerance through introgression of the *Pup1* QTL (i.e. crossing with varieties from group 1). "However, *Pup1* increases P uptake, which may exhaust the soil in the long run, especially in the absence of P-replenishment through fertilizer application," says Bilaro. The new QTLs for P-deficiency tolerance in the varieties in group 2 will be mapped. Bilaro began development of the *Pup1* introgression lines and QTL-mapping populations in January 2014.

In continuing his doctoral work, Bilaro intends to improve varieties grown by farmers through marker-assisted selection of *Pup1*; through this process, new donors of P-deficiency tolerance will be identified in addition to new QTLs that are potentially superior to *Pup1*. "My target is that I should in the next few years be able to provide farmers with varieties that can maintain relatively high yield in P-deficient soils to act as a buffer to high prices of fertilizers," says Bilaro.

"As the price of fertilizer continues to rise, genetic approaches such as the one being carried out by Mr Bilaro will definitely play a key role in addressing P-deficiency problems in a more sustainable way," says Ashura Luzi-Kihupi, a senior rice breeder who is a lecturer at SUA and also one of Bilaro's supervisors.

"The availability of varieties able to produce relatively high grain yield in low-P environments will contribute to increased rice production in a sustainable way for the benefit of smallholders who can't afford costly inputs," concludes Dramé.

Mouritala Sikirou

A former rice breeder at Institut national de recherches agricoles du Bénin (INRAB), Mouritala Sikirou was responsible for the AfricaRice-led STRASA project in Benin. He is currently pursuing his PhD studies studies on 'Genetic analysis of iron-toxicity tolerance in rice' through a Benin Government scholarship at the University of Abomey-Calavi, Benin.

Iron toxicity is a major factor limiting lowland rice production in West Africa. The inland valleys offer a huge potential for expansion of rice cultivation, but the potential risk of iron toxicity has to be addressed. Growing iron-tolerant varieties is one of the most affordable options available to the resource-poor farmers who have to deal with iron toxicity. Good screening tools and reliable genetic markers linked to desirable QTLs, especially those related to grain yield, are needed to increase the efficiency of breeding programs — their absence has been a bottleneck in

breeding for iron-toxicity tolerance. Sikirou's study was designed to overcome some of these bottlenecks. The objectives of the study are to: (1) determine the efficiency of screening under controlled conditions using hot-spot soil (i.e. soil from a known iron-toxicity hot spot); (2) identify QTLs for iron-toxicity tolerance through association mapping approaches; and (3) identify highly tolerant accessions of *Oryza glaberrima* that could be used as new donors.

Sikirou conducted screen-house experiments in 2012 and 2013 at AfricaRice in Cotonou, Benin over three seasons, using hot-spot soils from Edozhigi (Nigeria) and Niaouli (Benin). The results were similar to those obtained under field conditions, showing that the screening under controlled conditions using hot-spot soil was reliable. However, once fresh soil is collected and brought to a screen-house, it has to be kept water-saturated to obtain good results.

An association mapping panel (a sample of genotyped *O. sativa* lines representative of a larger collection, used for QTL mapping) developed by Cornell University was obtained from IRRI and evaluated in four iron hot spots (in Burkina Faso, Liberia, Nigeria and Sierra Leone). Results indicated that the panel was suitable for genetic analysis of iron toxicity; however, given the variation in iron toxicity between sites, some sites may be more appropriate for screening purposes than others. The data are being analyzed to map the QTLs for tolerance.

"Around 2000 *Oryza glaberrima* accessions from the AfricaRice collection were screened for iron-toxicity tolerance at a hot spot in Nigeria (Edozhigi) during the 2011/12 cropping season by AfricaRice," says Sikirou. The 100 best accessions, selected on the basis of leaf bronzing score and yield, were chosen and multi-location evaluation of these accessions was performed at the other three hot spots (i.e. Burkina Faso, Liberia and Sierra Leone). "The trials have been completed and data are being analyzed," says Sikirou. "I am expecting to identify the best *O. glaberrima* accessions that are adopted broadly across West Africa and could be used in breeding."

"The results of this research are important as they can help the breeding program fine-tune selection activity," says Sikirou. "We are also providing a new source of tolerance for iron toxicity for use in the breeding program."

"The results obtained by Sikirou are helpful in designing an appropriate selection strategy in the breeding program," say his supervisors Ramaiah Venuprasad, AfricaRice rainfed lowland rice breeder, and Professor Adam Ahanchédé, lecturer at the Faculty of Agronomic Sciences of the University of Abomey-Calavi. "The new donors identified for iron toxicity in this study are very valuable in our efforts to generate superior varieties."

Kazuki Saito, AfricaRice agronomist and another of Sikirou's supervisors, says, "His PhD will be completed soon. This is not the end, but the start for his career. I believe that he could contribute to developing new varieties with superior iron-toxicity tolerance for resource-poor farmers."

January

Project to develop high-value rice-based products launched

The University of Milan, Italy hosted the launch of an innovative project at the end of January. Entitled 'Development and evaluation of nutritious and higher value rice-based products from locally parboiled and lower grade milled rice', the project is supported by the GRiSP competitive 'New Frontier Research' grants.

The main objective of this 3-year project is to contribute to the improvement of the livelihoods of rice value-chain actors by developing, evaluating and disseminating a range of nutritionally enhanced rice-based products acceptable to local consumers using locally parboiled and lower-grade milled rice, which would otherwise be sold at discounted prices on the local market.

The project is carried out by AfricaRice (lead center) in partnership with CIRAD (France), a strategic GRiSP partner, the University of Milan (Italy), the Council for Scientific and Industrial Research (CSIR) Food Research Institute (Ghana) and the University of Abomey-Calavi (Benin).

Research activities will be carried out in the laboratories of the various partners and the results will be scaled out to African countries through the Africa-wide Rice Task Force on Processing and Value Addition.

The beneficiaries of the project will include small to medium-scale food processors and malnourished children, as well as collaborating scientists from AfricaRice member countries.

STRASA training workshop on seed production and commercialization

Twenty-four participants from Benin, Burkina Faso, The Gambia, Guinea, Mali and Senegal attended a training workshop on seed production and commercialization on 28 January to 8 February in Saint-Louis, Senegal.

STRASA organized the training course, which aimed to strengthen the theoretical and practical knowledge of seed technicians, so that they can ensure an effective seed value chain in terms of seed production techniques, quality control, certification, storage and marketing.

STRASA training on production and marketing of rice seed — field session

February

Inaugural workshop for joint project on *Striga*

AfricaRice is a partner in a Sustainable Crop Production Research for International Development (SCPRID) project, funded by the UK Department of International Development (DFID), Biotechnology and Biological Sciences Research Council (BBSRC) and the Bill & Melinda Gates Foundation (BMGF), called 'Genomic approaches to understanding resistance and virulence in the cereal–*Striga* interaction for targeted breeding of durable defence' (also known as STRIGA: *Striga* resistance genes for Africa). The University of Sheffield, UK, is lead institute and Makerere University, Uganda and Kenyatta University, Kenya are African partners.

Project scientists from AfricaRice attended the inaugural workshop at the University of Sheffield on 3–6 February.

Beautiful but deadly — a Striga*-infested field showing the devastation that this parasitic killer inflicts on rice in an experimental field (in this case varietal screening)*

New position: Director of Partnership and Capacity Strengthening

The increasing need for strong, visionary and strategic partnerships with AfricaRice's member states, and with donor agencies, regional economic communities and other research and development organizations in Africa, prompted AfricaRice to establish a new directorate. The Directorate for Partnership and Capacity Strengthening (DPC) includes the regional stations, the Marketing and Communications Unit, the Knowledge Management and Capacity Strengthening Unit and the Rice Sector Development Program.

Sam Bruce-Oliver was appointed as the first DPC director.

Fifth General Meeting of CARD

The Fifth General Meeting of CARD, held in Dakar, Senegal on 5–6 February, reviewed progress and emerging challenges over the past 5 years. The meeting brought together more than 170 officials from 23 African governments, donors, NGOs and private enterprises involved in the rice sector in Africa.

CARD was launched during the 2008 TICAD IV jointly by JICA and AGRA to double rice production in 23 sub-Saharan African countries.

Other CARD members are AfDB, AfricaRice, FAO, FARA, IFAD, IRRI, JIRCAS, NEPAD and the World Bank.

Representatives of AfricaRice and IRRI agreed that CARD is well on the way to achieving its goal of doubling sub-Saharan Africa's overall rice production to 28 Mt by 2018.

Rice component of CGIAR SARD-SC project launched

The rice component of the project 'Multinational–CGIAR support to agricultural research for development of strategic crops in Africa' (SARD-SC) was

launched at AfricaRice, Cotonou, Benin on 18 February. Thirty-eight participants attended, including national research and extension systems (NARES) representatives from 12 countries.

Launched in 2012, SARD-SC is a 5-year, multi-CGIAR center initiative funded by AfDB. It seeks to enhance the productivity and income derived from cassava, maize, rice and wheat — four of the six commodities that African heads of state have defined as strategic crops for Africa in CAADP. Its overall objective is to enhance food and nutrition security and contribute to poverty reduction in the AfDB's low-income Regional Member Countries.

The initiative is being implemented by three Africa-based CGIAR centers — AfricaRice for rice; the International Center for Agricultural Research in the Dry Areas (ICARDA) for wheat; and the International Institute of Tropical Agriculture (IITA) for cassava and maize. IITA is also the executing agency for the initiative. IFPRI is responsible for capacity-building for farmer organizations across the four value chains.

The rice component aims to contribute to poverty reduction and enhanced food security through value-chain development across Africa. Ten countries are involved in the initiative: Benin, Côte d'Ivoire, Ethiopia, Ghana, Madagascar, Niger, Nigeria, Senegal, Tanzania and Uganda. New technologies and innovations will be developed through task forces. The task forces are composed of NARS collaborators from participating countries and each focuses on one of five main intervention areas: breeding, agronomy, gender, processing/value addition and policy. Through the task forces, new technologies and innovations will be introduced as good agricultural practice (GAP) baskets in rice sector development hubs.

Participants from the SARD-SC project rice component launch

Agronomy and Processing and Value Addition Task Force meetings

The Africa-wide Rice Agronomy and Processing & Value Addition Task Forces held meetings in Cotonou on 19–22 February, immediately after the launching of the rice component of the SARD-SC project, as many of the project's activities will be implemented by the Agronomy Task Force.

The objectives of the meetings were to review 2012 activities in the rice sector development hubs and to plan for the next 5 years, with a focus on 2013, taking into consideration activities in the SARD-SC project.

March

AfricaRice sets up office in Sierra Leone

Vanguard of the new AfricaRice team in Sierra Leone, research coordinator Bert Meertens took up his post in Rokupr on 2 March. AfricaRice has been contracted to provide rice research and extension support to the WAAPP of the World Bank for 3 years. The majority of current work is focused on strengthening research and extension capacity. AfricaRice officially took over refurbished offices at the RARC in October, and the other two members of the team — office manager Lansana Koroma and agricultural economist Ali Touré — took up their posts in November.

Second phase of Green Super Rice project launched

The second phase of the Green Super Rice project was formally launched on 12–14 March, in Sanya, Hainan Province, China. Participants came from Chinese institutions, BMGF, AfricaRice, IRRI and NARES in Asia and Africa, and were welcomed by the President of the Chinese Academy of Agricultural Sciences (CAAS), which hosted the meeting.

Supported by BMGF, the Green Super Rice project aims to increase the income of resource-limited rice producers through the development and wide adoption of improved varieties and corresponding crop management technology.

Rice research and development in Africa create history

The news of unprecedented growth rates of rice production and productivity in sub-Saharan Africa, revealed through an analysis of independent data by AfricaRice, coupled with a remarkable upturn in the funding of the Center were highlighted as "historic developments in rice R&D in sub-Saharan Africa" by the AfricaRice Board of Trustees at its meeting held in Cotonou on 18–22 March.

"Research by AfricaRice and its partners has contributed significantly to the surge in rice production and yield in terms of policy advice, improved seed and cropping practices, technical information and knowledge, capacity development and support to the development of rice markets and value chains in sub-Saharan Africa," the Board stated.

"We are also extremely proud of the Director General and the staff of AfricaRice for their successful resource-mobilization efforts, which have led to a tripling of the Center's budget since 2006," the Board announced. "In 2013, AfricaRice's budget went up by 41% compared to [2012], which is the single largest increase in the history of the Center."

The Board highlighted a number of notable accomplishments of the Center, among them:

- Impressive quality of science of high relevance to AfricaRice member countries;
- 40% increase in the number of training workshops organized by AfricaRice, with 64% increase in the number of national participants, including 50% increase in women participants in 2012 compared to 2011;
- 20% increase in publications by AfricaRice and its national partners in scientific journals in 2012 compared to 2011;
- Increase in the number of PhD students from 43 in 2011 to 46 in 2012, and MSc students from 51 to 56;
- Launching of the rice sector development hubs across Africa — so far, 56 hubs have been selected by national partners in 20 African countries;
- Sustained efforts to develop the next generation of rice scientists on the continent through donor-supported training programs and the Africa-wide Rice Task Force mechanism;

Who's in the cage? The AfricaRice Board visiting the genebank during their March 2013 meeting in Cotonou

- Targeted support to specific countries with special needs to assist them in the development of their rice sector, in addition to addressing the regional and continental priorities in rice research for development.

The Board extended a warm welcome to Prof. Eric Tollens, an internationally renowned agricultural economist from Belgium, as a new Board member. We bade a fond farewell to Engida Getachew, former Board Chair and member, thanking him for his outstanding service and guidance to the Center during a challenging period.

2013 AfricaRice Dr Robert Carsky Award

At the 33rd AfricaRice Board Meeting, the 2013 AfricaRice Dr Robert Carsky Award was presented to AfricaRice senior scientist Francis E. Nwilene for his outstanding contribution to research and administration, and to Amoin Rose Nguessan for her outstanding contribution to research support.

The annual award, which was instituted by AfricaRice in honor of the late Dr Robert Carsky, is conferred on the most outstanding internationally recruited staff member and the most outstanding general support staff member, who have demonstrated high standards of excellence and made exceptional contributions to rice research, training and research support.

Mrs Rebecca Khelseau-Carsky flanked by award winners Amoin Rose Nguessan (left) and Francis E. Nwilene (right)

Food security information project launch

The project inception meeting for 'Improving food security information in Africa', funded by MAFF, was held in conjunction with the Africa-wide Rice Policy Task Force annual meeting at AfricaRice in Cotonou, 25–29 March (*see* 'Donor profile – Japan — Improving food security information', page 43, for more information on this project).

Japan Ambassador to Benin visits AfricaRice

A delegation from the Japanese Embassy in Benin, led by the ambassador, His Excellency Daini Tsukahara, visited AfricaRice on 26 March to get an overview of the Center's research activities. Japan has historically been an important donor to AfricaRice and has played a significant role in its development.

Field visit during the Japan ambassador's visit (from left to right): Koichi Futakuchi (AfricaRice Sustainable Productivity Enhancement Program leader), Takashi Kumashiro (AfricaRice Genetic Diversity and Improvement Program leader), HE Daini Tsukahara (Ambassador of Japan in Benin), Gérard Zoundji (Embassy of Japan, Benin), Kei Yoshimura (Embassy of Japan, Benin), Papa Abdoulaye Seck (then Director General, AfricaRice), Marco Wopereis (AfricaRice Deputy Director General) and Kazuki Saito (AfricaRice agronomist)

After a warm reception by the Director General, the Japanese delegation had a guided tour of the laboratories and experimental fields at AfricaRice, accompanied by the AfricaRice Deputy Director General and Japanese program leaders and scientists working at AfricaRice. The visit reaffirmed the strong ties between Japan and AfricaRice.

April

Workshop on Common External Tariff for the rice sector in West Africa

AfricaRice is actively involved in discussions with regional partners on the harmonization of regional rice policies, especially a strategy for reducing rice imports and the feasibility of a regional rice storage system. Ideas to reduce rice imports in the ECOWAS region have focused on the CET adopted by ECOWAS countries.

The major stakeholders in the rice sector in West Africa, led by ROPPA, held a workshop in Cotonou on 4–5 April to further debate the potential impact on rice-sector performance of an increase in the CET of rice.

New generation rice varieties unveiled for Africa

A new generation of high-performing rice varieties was launched under a new brand, 'ARICA' — 'Advanced Rice Varieties for Africa' — by the Africa-wide Rice Breeding Task Force at its annual meeting held in Kampala, Uganda, 8–12 April.

The Breeding Task Force announced the selection of the first five ARICA varieties (3 for rainfed lowland and 2 for upland rice-growing environments). The five ARICA varieties were selected on the basis of a rigorous evaluation of elite rice lines across the continent. All five out-yielded the most popular check varieties in the trials.

AfricaRice technician Pascal Degbey holding ARICA panicles, Cotonou

The ARICA varieties are the next generation of rice varieties for Africa, after the success of many improved rice varieties — notably the NERICAs, the Sahels, the WABs and the WITAs — developed by AfricaRice and its partners over the last 25 years. In order to be nominated as ARICA, a breeding line must prove to have a significant advantage over the best check varieties in a region for at least 3 seasons (*see* 'First fruits of the Africa-wide Rice Breeding Task Force: ARICA', page 32).

President of African Academy of Sciences visits AfricaRice

Prof. Ahmadou Lamine Ndiaye, President of the African Academy of Sciences (AAS), who is also the President of the Académie nationale des sciences et techniques du Sénégal (ANSTS), visited AfricaRice, Cotonou on 11 April.

He was accompanied by members of AAS, members of national academies of science and technology of several African countries, and a representative of The World Academy of Sciences. The delegation appreciated the Center's vision, strategy and achievements. In particular, Prof. Ndiaye said he was struck by the

concept of 'total scientist', which means that scientists have to be actively involved in fundraising.

Prof. Ahmadou Lamine Ndiaye, AAS President (fifth from left) with members of AfricaRice staff

Rice Emergency Initiative II

The second one-year phase of the Japan-funded Rice Emergency Initiative on seed-systems development and small-scale mechanization was launched at a 2-day event, 18–19 April, in Cotonou. Representatives of 22 of the 27 project countries attended, along with Japan's ambassador to Benin and representatives from JICA and the international NGO, BRAC (formerly known as the Bangladesh Rural Advancement Committee). (*See* 'Donor profile – Japan — Addressing the rice crisis in Africa', page 42, for more information on the initiative.)

Participants at the Rice Emergency Initiative II launch

Global Yield Gap Atlas (GYGA) project workshop

The GYGA project, led by the University of Nebraska, USA with support from BMGF, seeks to provide the first easily accessible and agronomically accurate web-based platform to estimate exploitable gaps in yield for the world's major food crops including rice.

As part of this project, AfricaRice is responsible for inventorying the state of rice production in Africa, and estimating potential yields using simulation crop models and climate and soil data.

The project was launched at AfricaRice, Cotonou, on 22–25 April. Participants included Kenneth Cassman, Director and Heuemann Professor of Agronomy, Nebraska Center for Energy Sciences Research, University of Nebraska. Professor Cassman is also Chair of the CGIAR Independent Science and Partnership Council (ISPC).

John Manful, AfricaRice grain quality specialist shows off the grain lab to participants in the GYGA project workshop, including ISPC Chair K.G. Cassman (yellow shirt)

The devastating effects of parasitic weeds on rice are evident in these potted plants

Preparing African rice farmers to face parasitic weeds in a changing environment

PARASITE is a multidisciplinary research project of Wageningen University, AfricaRice and the NARS of Benin (INRAB), Côte d'Ivoire (CNRA) and Tanzania (Mikocheni Agricultural Research Institute). A project mid-term workshop was held in Dar es Salaam, Tanzania, 22–26 April, which was attended by 19 participants from Benin, Côte d'Ivoire, Kenya, the Netherlands, Tanzania and Uganda.

The main objective of the workshop was to explore the overall progress of the different sub-projects, to discuss the integration and alignment of the sub-projects, and to develop an adapted log-frame for the rest of the project. An overview of progress and preliminary results of the field experiments and farmer participatory exercises were presented.

Stakeholders' workshop on rice value-chain development in East Africa

Rice experts from Kenya, Rwanda and Tanzania participated in the East Africa Rice Value Chain Development Stakeholders' Workshop that was jointly organized by AfricaRice and Africa Harvest, 23–25 April, in Nairobi, Kenya, with support from GRiSP. The main purpose of the workshop was to exchange ideas and experiences for developing effective rice value chains in East Africa. This first workshop was designed to kick-start joint activities in East Africa.

May

Abuja office opens

The AfricaRice Abuja (Nigeria) office opened in May with the placement of three scientists who will be working on the Nigerian Rice Transformation Agenda (RTA) of the Federal Ministry of Agriculture and Rural Development. The Abuja team comprises: Philip Atsaboghena Idinoba, agronomist–water management specialist; Gbenga Akinwale, rice seed systems specialist; and Chijioke Maduka Osuji, rice value-chain and postharvest specialist. (For more information on the RTA, *see* Box 'Case study: Nigerian Rice Transformation Agenda', page 14.)

Rice pathology workshop for East and Southern Africa

AfricaRice partnered with IRRI to organize a 5-day rice pathology workshop, 6–10 May, at Burundi University, Bujumbura, Burundi. The workshop attracted 23 participants from seven East and Southern African countries — Burundi, Kenya, Malawi, Mozambique, Rwanda, Tanzania and Uganda.

Joseph Bigirimana, IRRI coordinator for East and Southern Africa, welcomed the participants. During the course of the workshop, they visited disease hot spots, collected diseased rice samples, and isolated and purified rice pathogens for molecular and pathogenic characterization.

The workshop also presented an opportunity for pathologists from IRRI and AfricaRice to report and discuss their plant pathology activities in East and Southern Africa. Their efforts support the develop-

ment of rice material with useful resistance traits for use in the region.

Addressing the gender dimensions of rice research and development

An Africa-wide Task Force on Gender in Rice Research and Technology Development, established in 2011, supports the efforts of AfricaRice and its national partners in addressing gender concerns, especially gender gaps in access to technologies and knowledge, specific technology needs of women, and women's potential roles as contributors and beneficiaries of technologies in rice value chains.

The Gender Task Force, which functions through gender focal points in AfricaRice member countries, has been actively involved in a research project on 'Gender and climate change in stress-prone rice environments in Asia and Africa', with support from GRiSP. Participants at a workshop, held on 6–10 May at AfricaRice in Cotonou, came together to synthesize and draw lessons from the findings of this research.

Other important objectives of the workshop were to strengthen capacities for conducting research on gender issues and integrating gender into rice research and technology processes, and to develop detailed work plans under the African component of the GRiSP gender strategy.

Rice sector development hub network

AfricaRice introduced the rice sector development hubs as an innovative research-for-development tool to facilitate the spread of innovations and achieve greater impact. The hubs bring together actors from the whole rice value chain in multi-stakeholder platforms to facilitate change.

AfricaRice has been working with its national partners across the continent to set up the hubs based on their selection according to the main rice-growing environment. A consultation with NARS' directors general on the governance and management of the hubs, held in Cotonou on 16–17 May, re-emphasized the role of the hubs in linking rice-sector development at the national and community level.

The hubs act as the operational arms of national rice-sector development strategies; they are demand-driven and operated by local rice value-chain actors (including farmers and processors). The consultation also identified and delimited the respective roles of the NARS and AfricaRice in the hubs.

Meeting of the Africa-wide Task Force on Gender in Rice Research and Technology Development

Consultation on the management and governance of the rice hubs, Cotonou

JIRCAS pre-TICAD workshop

On 31 May, the AfricaRice delegation to TICAD V attended a pre-Conference workshop on 'New Stages of Agricultural Research in Africa', organized by JIRCAS at the University of Tokyo.

AfricaRice Director General Papa Abdoulaye Seck gave a keynote speech on 'Conducting rice science for impact in Africa'. His audience included high-level representatives from the CGIAR Fund Office, CIAT, Center for International Forestry Research (CIFOR) and JIRCAS.

The AfricaRice delegation also visited MOFA and MAFF, where they held fruitful discussions on ongoing and future collaboration.

June

TICAD V

A four-person delegation from AfricaRice attended the Fifth Tokyo International Conference on African Development (TICAD V) in Yokohama, Japan, 1–3 June (*see* 'Donor profile – Japan — TICAD V', page 45). Formal and informal meetings in and around the Conference included an audience with the President of Senegal, at which AfricaRice was requested to develop an action plan to boost the country's rice sector.

The Director General also spoke at a side-event on CARD, commenting on the Coalition's importance for Africa's food security and speaking in support of establishing an international research center for agricultural mechanization in sub-Saharan Africa. He also emphasized the importance of private-sector involvement in Africa's rice sector.

Members of the AfricaRice delegation also attended a meeting of the CARD steering committee and visited a machinery manufacturer in Osaka.

IFAD-funded project 'Strengthening rice value chains in West and Central Africa' launched

Building on the success of the IFAD-funded project on rice development in West and Central Africa, a new project was launched to strengthen rice value chains in West and Central Africa, 3–4 June, at AfricaRice, Cotonou.

The project's objectives are to improve the productivity and efficiency of rice value chains and increase the incomes of value-chain actors. The project will be implemented in four countries: the three countries already involved in the project's first phase — Democratic Republic of Congo, Guinea and Sierra Leone — plus Senegal.

The project has three components: productivity enhancement, improvement of value addition and capacity-strengthening. It will focus on the development of GAP baskets, rice seed systems, and efficient harvest and postharvest practices in the rice sector development hubs in the four West and Central African countries.

It seeks to facilitate wide-scale adoption of new knowledge and improved technologies, establish functional linkages among actors along the rice value chain, and train farmers and other value-chain actors (input dealers, rice millers and rice marketers).

Visit of President Obama to the AfricaRice booth in Senegal

In June 2013, US President Barack Obama traveled to Africa with Senegal as his first stop, testifying to his strong support to agriculture and food security.

As part of the US Government's global hunger and food security initiative 'Feed the Future' (FTF), the United States Agency for International Development (USAID) organized an Agricultural Technology Marketplace on 28 June in Dakar for the President's visit.

The Marketplace enabled a number of regional businesses, farmers and NGOs to demonstrate their work and products.

AfricaRice was invited to demonstrate how key research and innovation can help improve the lives of smallholder farmers.

US President Barack Obama with AfricaRice's Karim Traoré at the USAID Technology Marketplace, Dakar (photo courtesy of USAID)

President Obama visited the AfricaRice booth and admired the improved rice varieties displayed there. The President invited members of his staff to see the rice varieties. The USAID Chief Scientist highlighted this event as an example of how international research is contributing to food security in Africa.

July

Dutch Ambassador to Benin visits AfricaRice

A delegation from the Dutch Embassy in Benin led by Ambassador Jos van Aggelen visited AfricaRice, Cotonou on 11 July. The Ambassador and his team were warmly received by the AfricaRice deputy director general. The delegation met with AfricaRice scientists and discussed issues relating to research collaboration, including the partnership between AfricaRice and the University of Wageningen in the Netherlands.

Visit of the CEO of CIRAD to AfricaRice

The new CEO of CIRAD, Michel Eddi traveled to sub-Saharan Africa for the first time and his first stop was AfricaRice, where he was received by the Director General on 12 July.

Extensive discussions were held relating to AfricaRice's partnership with CIRAD under the GRiSP framework and under bilateral cooperation. The CEO toured the facilities and interacted with AfricaRice and CIRAD scientists.

Participation in FARA General Assembly and Science Week

The FARA General Assembly and the Sixth Africa Agriculture Science Week (AASW) were held in Accra, Ghana, 15–19 July. The AASW brought together over 1000 delegates from across Africa, including 60 scientists and experts from the CGIAR Consortium, representing many of the CGIAR's centers and research programs.

AfricaRice genebank researcher Daniel Tia Dro showing rice varieties at the CGIAR booth, FARA Africa Agriculture Science Week

The AfricaRice delegation was led by the Director General, who attended both events and had discussions with representatives of sub-regional agricultural research organizations, civil society representatives and the CGIAR Consortium on agriculture-related issues.

Seeds of improved rice varieties — including the five recently released ARICAs, the upland and lowland NERICAs and the Sahel series developed by AfricaRice and its partners — were displayed at the CGIAR booth at AASW.

Double boost for rice mechanization

A workshop at the AfricaRice Sahel station, Ndiaye, Senegal from 29 July to 1 August saw the launching of both the EU-funded 'South–South collaboration on rice mechanization in Africa' project, and the Africa-wide Rice Mechanization Task Force.

Unlike most of the other Africa-wide task forces that were launched between 2010 and 2012, the Rice Mechanization Task Force did not have a forerunner in ROCARIZ (West and Central Africa Rice Research and Development Network) in the late 1990s and early 2000s. "This is the first rice-mechanization task force," says value-chain and postharvest technology consultant Jean Moreira. "It is also the only task force to specifically include the private sector. Consequently, the task force typically has two representatives from each member country, one from the national program [public sector] and one from the private sector."

Historically, research into mechanization of the rice sector in Africa has focused on the field, from land preparation to harvest. However, not only were imported machines frequently poorly adapted to African conditions, but the 'mechanizers' were only looking at half the story. Both the quantity and quality of African rice suffer huge losses in the *postharvest* part of the value chain, especially in threshing and processing. This means, says Moreira, that "research and the private sector have to work together, because only the private sector can provide the scaling up required to truly mechanize Africa's rice value chain."

AfricaRice Director of Research for Development Marco Wopereis explains: "the Mechanization Task Force is not involved in research in the traditional sense, but rather in adaptive research. The other major activity of the task force is training."

The first step in this adaptive research and training process is to assess the status of mechanization within each country. Local experts are simply asked to assess answers to a series of broad questions: Who does what? What equipment is imported and what is fabricated locally? What training is available? And, what human resources are available in country?

The second step is to introduce and test equipment for adoption. The process usually starts with the introduction of a machine from elsewhere. This 'model' is then tested in collaboration with farmers or other end-users, and its drawbacks identified. Solutions to the identified problems are proposed and the imported model duly modified.

Once a satisfactory design is achieved, the machine can be manufactured locally. In the light of further testing, the new prototype can be modified until those involved are happy with it. At this point, technical drawings are prepared so that 'anyone' can build the new machine. "We have also produced templates of the non-mechanical parts of popular machines like the 'ASI' thresher–cleaner — actual-size pieces cut in thin sheet metal that can be held against the plate metal used in construction to guide the cutting process," says Moreira.

With the prototype and technical drawings available, key fabricators are brought together and trained in the machine's construction. For example, in 2013 alone, 57 fabricators from 10 countries were trained in the construction of the 'ASI' thresher–cleaner. In Nigeria, the 2-week course involved 25 fabricators who constructed five of the locally adapted ASIs, which they named 'Agricultural Transformation Agenda

Thresher' (ATAT) (*see also* 'Case study: Nigerian Rice Transformation Agenda', pages 14–15).

"Another novel aspect of the Mechanization Task Force is the development of a wider network of mechanization experts, end-users and manufacturers across Africa, Asia and Brazil, established in collaboration with FARA and IRRI," says Moreira. "Activities of this network will include visits of African mechanization experts/fabricators to end-users in Brazil and Asia."

September

New videos on weed management released

Weeds are important an important constraint on rice production. Effective weed management can increase yields by more than 50%, but usually takes a lot of time. It is therefore worthwhile for farmers to invest in labor-saving weed management tools.

Opening frames from two of the farmer-to-farmer videos on weed management

With support from USAID, AfricaRice has produced a two-DVD pack called *Weed management: Farmer-to-farmer instruction videos on effective and labor-saving weed management in lowland rice*.

The videos were released on 6 September in English, French, Portuguese, Kiswahili and Dagbani languages; English and French language versions have been posted on YouTube (*see* 'Publications — Videos', page 102).

Director General Papa Seck appointed Senegal Minister of Agriculture and Rural Equipment

At the 34th Board of Trustees meeting, the Board proudly announced to AfricaRice staff that Director General Papa A. Seck had been appointed by the President of Senegal as the new Minister of Agriculture and Rural Equipment.

"After 7 years of outstanding leadership, Dr Seck will end his appointment at AfricaRice on 12 September," the Board said.

"Dr Seck is leaving behind him a well-managed, financially sound and scientifically vibrant organization," the Board statement continued. "His vision and passionate commitment to the mission and goals of CGIAR and AfricaRice have transformed the Center and taken it to new levels of excellence. We are sure that he will bring the same dedication and visionary management style to his new mission and we offer him warm felicitations and best wishes for the future."

The Board stated that immediate action would be taken to ensure interim leadership and that an effective and efficient recruitment process for selecting Dr Seck's successor would be set up, in accordance with the special intergovernmental status of AfricaRice and the guidelines laid down in its Constitution.

Adama Traoré named Interim Director General of AfricaRice

The AficaRice Board appointed former Board member and vice-chair Adama Traoré as Interim Director General with effect from 12 September.

"Dr Traoré has a wealth of scientific and leadership experience that will help the AfricaRice management and staff to maintain the momentum and continue the legacy of excellence established by Dr Seck," said Board Chair Peter Matlon.

A Malian national, Adama Traoré was President and Executive Secretary of CNRA of Mali. He has also held the positions of Chair of CORAF/WECARD, and Vice-Chair of FARA.

He has been on the Boards of three international centers that are members of the CGIAR Consortium — International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), IITA and AfricaRice.

Former Board vice-chair, now Interim Director General, Adama Traoré

Senegal rice strategy workshop

On 16 and 17 September, AfricaRice Sahel station hosted a workshop to determine the feasibility and resources required for Senegal to boost national rice production to 1.6 Mt of paddy by 2017, the target of its revised national plan for rice self-sufficiency. The regional agricultural development directors of all 10 rice-producing regions of the country attended the meeting, along with representatives of the Ministry of Agriculture and Rural Equipment, SAED, Anambe, Programme national d'autosuffisance en riz (PNAR) and farmer organizations. (*See* Box 'Case study: Senegal strategy workshop', page 16, for more information.)

October

Third Africa Rice Congress

AfricaRice, FAO and IRAD (Cameroon) co-sponsored the Third Africa Rice Congress, held at the Hilton Hotel, Yaoundé, Cameroon from 21 to 24 October. The Congress adopted the theme 'Rice Science for Food Security through Smallholder and Agri-business Development in Africa', and built on the success and outputs of the Second Africa Rice Congress ('Innovation and Partnerships to Realize Africa's Rice Potential', Bamako, Mali, 22–26 March 2010).

The Congress brought together over 650 participants from 60 countries (35 African countries were represented), including rice farmers, seed producers, rice processors, input dealers, agricultural machinery manufacturers, representatives from agricultural ministries, national and international rice research and extension communities, NGOs, donors and other development partners, and the media.

In the context of plenary and mini-symposium sessions, almost 250 oral and poster presentations were made, along with valuable discussion and networking. The Congress was opened and closed by Her Excellency Dr Madeleine Tchuinte, Minister of Scientific Research and Innovation of the Republic of Cameroon on behalf of His Excellency Philemon Yang, Prime Minister of Cameroon. It also included a Ministerial Dialogue on 'Rice sector development'

with ministers from Chad, The Gambia, Mali and Senegal, and a 'World Café: Listening and defining priorities with the rice sector stakeholders'. (*See* the Feature on page 17 for more details.)

The 'ASI' thresher–cleaner being demonstrated at the mechanization expo at the Third Africa Rice Congress

November

FAO pledges to work with AfricaRice to support rice strategies for the future

Congratulating AfricaRice on its commitment to improving food security in Africa, FAO Director General José Graziano da Silva said, "We wish to join our efforts with AfricaRice to support rice strategies for the future," during his visit to AfricaRice, Cotonou on 4 November.

"Rice is a staple food in parts of Asia, Africa and Latin America where two-thirds of the world's hungry people live," the FAO Director General remarked, highlighting the major challenges facing rice production, such as water scarcity and salinity, which are predicted to increase because of climate change.

After extending a warm welcome to Dr da Silva, AfricaRice Interim Director General Adama Traoré said that FAO and AfricaRice have been collaborating closely in several areas, such as the collection and conservation of rice genetic resources, the development of rice seed systems, NERICA dissemination efforts, and the Emergency Rice Initiative in Africa after the 2008 food crisis.

"The most recent example of partnership was the successful co-organization of the Third Africa Rice Congress that was held in Cameroon from 21 to 24 October 2013," Dr Traoré said.

The Congress recommendations specifically address the need for FAO to play a more prominent role in stimulating national, regional and global partnerships to develop Africa's rice sector, as part of the efforts of CARD and under the overall umbrella of CAADP.

The FAO delegation had a guided tour of the AfricaRice experimental fields and the rice genebank. "The visit, despite the short time, was very useful to demonstrate the commitment of the researchers and all staff to support rice productivity increase, especially in the Sahel," Dr da Silva observed. "I hope that our partnership will improve in the future for achieving food security for all."

FAO Director General José Graziano da Silva with AfricaRice Interim Director General Adama Traoré and Sustainable Productivity Enhancement Program Leader Koichi Futakuchi

A tribute to agricultural research and partnership in Africa: Dr Papa Seck receives France's *Légion d'honneur*

The insignia of the Chevalier of the Légion d'honneur — France's highest civilian distinction — was conferred on Dr Papa Abdoulaye Seck by Madame Kuster-Ménager, Ambassador of France in Benin, in a brief ceremony in Cotonou on 22 November.

Established by Napoleon Bonaparte in 1802, the Légion d'honneur honors individuals for exemplary service and distinguished achievements. Dr Seck received this prestigious award for his outstanding contribution and dedication to agricultural research and development in Africa.

Emphasizing Dr Seck's professional competence, his human qualities and his strong commitment to food security in Africa, the Ambassador remarked, "He is a well-known personality in the scientific world and is attentive to Africa's needs and its realities."

The Ambassador praised Dr Seck's spirit of partnership and his love for — and mastery of — the French language. She highlighted that Dr Seck has significantly strengthened the scientific collaboration between African, French and international research institutions during his leadership of Institut sénégalais de recherches agricoles (ISRA) and subsequently of AfricaRice.

Former AfricaRice Director General, Dr Papa Abdoulaye Seck receiving the insignia of the Chevalier of the Légion d'honneur from Mme Kuster-Ménager, Ambassador of France in Benin

"I feel deeply honored," said Dr Seck. "This recognition is a tribute to the African scientific community and the cooperation between France and Africa. I therefore share this honor with my colleagues of ISRA, AfricaRice, ANSTS, AAS, Institut national de la recherche agronomique, CIRAD, IRD and the CGIAR Consortium.

AfricaRice Interim Director General Adama Traoré remarked, "This is a proud moment for AfricaRice and all its partners, including the national agricultural research systems of Africa and all the members of GRiSP."

December

Chad hosts 29th session of Council of Ministers

The Council of Ministers is the highest governing body of AfricaRice. It comprises the ministers of agriculture of all the AfricaRice member states. The 29th Session of the Council of Ministers was held in N'Djamena, Chad, 10–11 December, under the chairmanship of Hon. Moussa Mahamat Agrey, Chadian Minister of Agriculture and Irrigation.

The participants welcomed the progress made by AfricaRice since the Council last met in The Gambia in 2011.

The inaugural message from the Chadian Prime Minister (delivered by the Minister of Agriculture and Irrigation) commended the AfricaRice leadership for its successful efforts to increase the number of member countries.

"On behalf of the Council of Ministers, we extend a special welcome to Rwanda, which recently joined

AfricaRice. This brings the total number of AfricaRice member countries to 25," the Chair of the Council of Ministers remarked.

The Council formulated a number of resolutions. AfricaRice was urged to:

- Support member countries in the provision of quality seed to face emergency situations, and in the development of viable seed systems;
- Lead capacity-development efforts along the rice value chain;
- Strengthen African Union participation in AfricaRice activities;
- Continue efforts to increase the number of member countries;
- Continue efforts to encourage member countries to pay their contributions.

A special resolution focused on the importance of the rice sector development hub network: Ministers urged NARS to further operationalize and strengthen activities in the hubs.

The Council noted with satisfaction the intention to open a regional research center in Central Africa in response to strong demand from the countries of that sub-region.

The Council recognized the important contribution of the Benin government, which has hosted AfricaRice temporary headquarters since 2005. It approved the phased plan to return AfricaRice headquarters to Côte d'Ivoire starting from June 2014, provided that the Ivorian government fulfills its commitments to facilitate the return. It asked AfricaRice to consider proper management of the socio-economic consequences on human resources in Benin in relation to the departure.

A special motion was passed by the Council to congratulate and thank Papa Abdoulaye Seck, the former AfricaRice Director General, who had recently been appointed Senegal's Minister of Agriculture and Rural Equipment.

The Council also thanked the Interim Director General Adama Traoré for his efforts to ensure a seamless transition.

After reviewing the process of recruitment of the new Director General, the Council asked for the new Director General be selected in September 2014 and be in post by January 2015.

During the closing ceremony, Uganda was asked to take over the chairmanship of the AfricaRice Council of Ministers. Uganda was the first country from East Africa to join AfricaRice in 2007.

"This is a great honor for us," said Hon. Ruth Nankabirwa, Uganda Minister of State, representing the Minister of Agriculture, Animal Industry and Fisheries. "Our country has benefitted a lot from technologies generated by AfricaRice. We pledge our support and we will continue to advocate for it across the region."

Top table at the Council of Ministers meeting (left to right): Hon. Bruno Jean Richard Itoua, Minister of Scientific Research, Republic of Congo; Peter Matlon, AfricaRice Board Chair; Hon. Moussa Mahamat Agrey, Minister of Agriculture and Irrigation, Chad; Hon. Ruth Nankabirwa, Minister of State for Fisheries, Uganda; and Adama Traoré, AfricaRice Interim Director General

Financial statements

Statement of financial position

As at 31 December 2013

ASSETS

	2013 (US$)	2012 (US$)
Current assets		
Cash and cash equivalent	13,914,637	8,038,183
Accounts receivable:		
Donors	8,265,287	10,307,822
Employees (net of allowances)	536,290	431,054
Others (net of allowances)	885,723	432,257
Inventories	319,740	299,701
Prepaid expenses	664,368	338,890
Total current assets	**24,586,046**	**19,847,907**
Property and equipment		
Property and equipment	15,103,741	14,149,832
Less: Accumulated depreciation	(14,472,074)	(13,661,526)
Total property and equipment – Net	**631,667**	**488,306**
Total assets	**25,217,713**	**20,336,213**

LIABILITIES AND NET ASSETS

	2013 (US$)	2012 (US$)
Current liabilities		
Bank balances (overdraft)		39,574
Accounts payable:		
Donors	6,473,990	2,573,211
Employees	736,293	562,259
Others	982,992	705,857
Employees investment account	214,562	214,365
Provisions and accruals	3,694,520	3,702,580
Total current liabilities	**12,102,356**	**7,797,846**
TOTAL LIABILITIES	**12,102,356**	**7,797,846**
Net assets		
Unrestricted net assets:		
Undesignated	12,483,690	12,050,061
Designated	631,667	488,306
TOTAL NET ASSETS	**13,115,357**	**12,538,367**
TOTAL LIABILITIES & NET ASSETS	**25,217,713**	**20,336,213**

Statement of activities

For the year ended 31 December 2013

(Expressed in US$)

Income statement by source

	2013				2012			
	Unrestricted	**CRP**	**Non-CRP**	**Total**	**Unrestricted**	**CRP**	**Non-CRP**	**Total**
Grant revenue								
Window 1 & 2		9,484,716		9,484,716		9,805,025		9,805,025
Window 3	269,565	3,991,578	5,738,707	9,999,850	1,142,107	1,645,120		2,787,227
Bilateral	508,093	8,518,203	1,684,059	10,710,355	371,778	9,208,327	257,510	9,837,615
Other revenue and gains	410,201			410,201	241,094			241,094
Total revenues and gains	1,187,858	21,994,498	7,422,766	30,605,122	1,754,978	20,658,472	257,510	22,670,960
Research expenses	12,007	21,994,498	7,422,766	29,429,271	5,988	20,658,472	257,510	20,921,969
General & administration expenses	3,954,636			3,954,636	3,213,102			3,213,102
Other expenses & losses				—				—
Subtotal expenses & losses	3,966,643	21,994,498	7,422,766	33,383,907	3,219,090	20,658,472	257,510	24,135,071
Indirect cost recovery	(3,355,775)			(3,355,775)	(2,013,423)			(2,013,423)
Total operating expenses	610,868	21,994,498	7,422,766	30,028,132	1,205,667	20,658,472	257,510	22,121,649
Surplus/(deficit) for the year	576,990	—	—	576,990	549,311	—	—	549,311
Expenses by function								
Personnel costs	2,156,835	7,041,501	1,154,856	10,353,192	1,577,299	6,886,941	26,368	8,490,608
CGIAR collaboration		108,560		108,560				—
Other collaboration		3,792,960	2,995,253	6,788,213		3,104,973		3,104,973
Supplies and services	1,187,405	8,956,943	2,778,412	12,922,760	1,290,901	7,441,423	132,028	8,864,352
Travel	447,815	1,607,789	291,417	2,347,021	190,138	1,779,011	29,415	1,998,564
Depreciation	174,588	486,744	202,829	864,160	160,751	1,446,124	69,699	1,676,574
Subtotal expenses & losses	**3,966,643**	**21,994,498**	**7,422,766**	**33,383,907**	**3,219,090**	**20,658,472**	**257,510**	**24,135,071**
Indirect cost recovery	(3,355,775)			(3,355,775)	(2,013,423)			(2,013,423)
Total operating expenses	**610,868**	**21,994,498**	**7,422,766**	**30,028,132**	**1,205,667**	**20,658,472**	**257,510**	**22,121,649**

Schedule of grant revenues

For the year ended 31 December 2013

(Expressed in US$)

Donor[1]	Grant period	For the year ended 31 December 2013				Grant 2012
		Grant pledges available	Accounts receivable	Accounts payable	Grant 2013	
UNRESTRICTED						
Japan	Jan–Dec '13	269,565			269,565	371,778
Total unrestricted grants		269,565			269,565	371,778
TEMPORARILY RESTRICTED BILATERAL GRANTS						
AfDB – NERICA Dissemination project	Jan '04–Dec '11	1,230,000		13,427		2,000
CARD Secretariat – Consultancy services	Oct '09–Jul '10	24,415				6,978
ANR – ESCAPE project	Jul '11–Nov '14	152,820		939	70,126	51,269
ACP – AfroWEEDS project	Oct '09–Oct '12	408,453		21	(39)	76,387
BADEA – 2010 IRM training	Jul '10–Dec '11	330,000		0		5,453
BADEA – 2012 IRM training	Nov '12–Dec '12	310,000	559			262,786
BADEA – Rice production training in Togo	Nov '13–Dec '13	64,710	74,852		74,852	
BETICO – Consultancy services	Closed project			0		2,054
Bioversity – DIIVA project phase 1	Nov '09–Dec '12	168,300	0			29,789
Bioversity – DIIVA project phase 2	Closed project					147,752
CAAS – Green Super Rice project phase 1	Nov '08–Oct '11	3,449,862	0			(340)
CAAS – Green Super Rice project phase 2	Oct '12–Oct '15	1,300,000	153,717		589,050	134,567
Canada – Support to Rice Research in Africa	Apr '11–Mar '16	7,136,573		570,392	1,749,713	1,077,344

1. Abbreviations are spelled out in the list that starts on page 104.

Donor	Grant period	For the year ended 31 December 2013				Grant 2012
		Grant pledges available	Accounts receivable	Accounts payable	Grant 2013	
CFC – Central Africa rice project	Jan '08–Dec '12	2,500,961	72,085		(72,255)	547,223
AVRDC – Vegetable value chain in rice-based crop	Apr '12–Dec '12	15,000	0			15,000
DFID – *Striga* project	May '08–Dec '12	76,313	0			5,845
DFID – SCPRID project	Sep '13–Aug '17	387,303		42,018	86,937	
EC-IFAD – RAP project	Jan '11–Dec '14	3,307,200	962,762		905,947	694,352
EC-IFAD – Policy project	Jun '10–Dec '13	2,756,000	113,908		174,614	901,051
EC-IFAD – South–South mechanization project	Aug '12–Sep '14	551,200		203,836	293,850	
FAO – APO training	May '11–Jun '12	4,200				4,200
Gatsby Foundation–IRRI – Germplasm collection	Jan '13–Dec '13	11,776	4,000		11,776	
GIZ – GlobE project	Jul '13–Jun '16	551,200		46,539	45,839	
GTZ – MICCORDEA project	Jan '10–Dec '13	1,608,000	0		131,237	437,855
GTZ – Attributed grant	Jan '13–Dec '13	312,806	18		307,853	196,072
IBRD – CGIAR Collaboration Fund	Jan '11–open	414,492				58,289
AIDP-Liberia government – Liberia agriculture project	Oct '12–Jul '14	854,232	172,070		445,425	142,927
IFAD – NERICA seed in West and Central Africa project	Dec '07–Dec '12	1,500,000	0			49,146
IFAD – Value chain in West and Central Africa project	Mar '13–Mar '16	1,470,000		74,841	370,659	
IFAR – CGIAR fellowship program	Jan '09–Dec '12	55,000				8,609
USAID – Feed the Future project in Ghana	Feb '12–Dec '12	299,822		1,282	(4,281)	296,811
USAID–IITA – Africa RISING	Apr '12–Dec '12	170,000	2,465			172,465
AfDB–IITA – SARD-SC project	May '12–Nov '16	15,500,500	443,009		1,919,598	35,289

Donor	Grant period	For the year ended 31 December 2013				Grant 2012
		Grant pledges available	Accounts receivable	Accounts payable	Grant 2013	
BFGF–IRRI – STRASA project phase 2	Mar '11–Feb '14	4,800,000	357,081		1,598,246	1,792,161
GRiSP/IRRI–USAID – University linkage fund	Jul '13–Dec '13	14,700		223	14,700	
Japan – Interspecific Hybridization Project	Jan '00–Mar '14	324,000	424,586		411,954	402,792
Japan – Increasing quality project	Jan '03–Mar '14	86,000	59,867		68,668	60,849
Japan – Development of interspecific progenies project	Jan '03–Mar '14	86,000	80,008		83,922	51,724
Japan – High yield varieties in humid zone project	Dec '05–Mar '14	86,000	107,005		102,852	102,127
Japan – Physiological & genetic investigation project	Jan '07–Mar '14	86,000	137,318		139,715	104,617
Japan – Development of sustainable rice farming systems project	Jan '08–Mar '14	53,000	88,250		82,059	133,812
Japan – Breeding project	Jan '10–Dec '14	8,000,000	1,632,000		1,424,041	1,538,675
Japan – SMART-IV project	Oct '09–Sep '14	3,055,239		409,131	545,228	599,526
Japan – Capacity-building (Abe)	Sep '10–Feb '11	11,500		0		
Japan–CGIAR Fellowship program (Abe)	Nov '10–Feb '11	12,700			5,807	602
Japan–CGIAR Fellowship program (Saito)	Nov '10–Mar '11	7,000		5,633		745
Japan–CGIAR Fellowship (Michi)	Jan '12–Dec '12	7,192		6,420		
Japan – Statistics project	Feb '13–Jan '15	584,080		169,622	362,899	4,212
JIRCAS – Fellowship program	Nov '12 Dec '12	9,310		0	665	51,560
Japan – Emergency project phase 2	Apr '13–Oct '14	9,000,000		3,081,293	5,738,707	8,774
Japan – RYMV project	Jan '00–Mar '14	86,000	101,824		107,911	94,847
JICA–AfricaRice – Collaboration project	Apr '04–open	164,035		0		

Donor	Grant period	For the year ended 31 December 2013				Grant 2012
		Grant pledges available	Accounts receivable	Accounts payable	Grant 2013	
JIRCAS – Collaboration project in Benin	Jun '10–open	4,000		0		3,852
Michigan State University – Competitiveness study	Oct '10–Aug '11	49,335				(121)
Mali LABOSEM – Seed lab audit project	Jan '12–Dec '13	95,448		3,102	38,648	54,240
Nebraska University – GYGA project	Feb '12–Mar '14	102,350		20,580	71,114	10,656
Nigeria Federal Government – RTA project	Jan '13–Dec '15	1,666,170		949,712	848,133	
IBRD–Sierra Leone government – WAAPP Sierra Leone	Mar '13-Feb '16	2,164,528	220,968		220,968	
IBRD–Liberia government – WAAPP Liberia	Jul '13–Jun '16	1,540,112		150,265	3,746	
IFAD PADER – Seed project	Feb '11–Dec '13	54,820	0			66,279
Syngenta Foundation – Value chains project	Apr '11–Jul '12	416,456	0			29,816
UEMOA–PACER – Saint-Louis Center of Excellence project	Aug '12–Aug '14	301,205		40,056	127,139	
UNDP – Liberia seed production project	Apr '09–Apr '11	296,604	0			(82)
WOTRO–Wageningen University – PARASITE project	Apr '11–Mar '15	139,923	35,813		44,419	52,646
Sub-total restricted bilateral grants		**80,224,845**	**5,244,164**	**5,789,333**	**19,142,442**	**10,525,481**

Donor	Grant period	For the year ended 31 December 2013				Grant 2012
		Grant pledges available	Accounts receivable	Accounts payable	Grant 2013	
CHALLENGE PROGRAMS						
Generation Challenge Program						
CIMMYT-GCP-Project SP1-G4008-05	Jan '08–Dec '10	19,200				(1,320)
GCP-I-Bridges-WARDA/IRD	Aug '07–Dec '09	80,000	9,000			
GCP-NAM population-WARDA/CIAT	Aug '08–Dec '13	114,058	10,508		23,098	
GCP Rice Challenge Initiative	Jun '09–Mar '14	2,717,754		120,163	767,008	583,472
GCP Drought Avoidance Root	Nov '08–Sep '11	100,800				3,324
Sub-total Challenge Program grants		**3,031,812**	**19,508**	**120,163**	**790,106**	**585,476**
CGIAR Research Program (CRP) grants						
CCAFS CRP total	Jan '11–Dec '15	787,980	159,422		397,470	740,674
GRiSP CRP total	Jan '11–Dec '15	15,613,048	2,463,002		7,602,000	7,790,001
GRiSP – IRRI Bilateral projects	Jan '11–Dec '15	2,189,745	235,508	7,949	1,161,563	896,471
Sub-total CRP grants		**18,590,773**	**2,857,931**	**7,949**	**9,161,033**	**9,427,147**
CGIAR Genebank Stability grants						
Fund Council Genebank	Jan '11–Dec '16	2,311,385	143,684	100,746	323,683	377,878
Sub-total CGIAR Genebank Stability Fund grants		**2,311,385**	**143,684**	**100,746**	**323,683**	**377,878**
Total restricted grants		**104,158,815**	**8,265,287**	**6,018,190**	**29,417,264**	**20,915,982**
Total grants		**104,428,380**	**8,265,287**	**6,018,190**	**29,789,042**	**21,287,760**

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(As on 31 December 2013)

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	Adama Traoré (Mali), Interim Director General, AfricaRice§

‡ Left in 2013.

§ Formerly Board Vice-Chair.

The 2013 Board of Trustees prior to Papa Seck's departure together with some AfricaRice staff

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(As on 31 December 2013)

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Rougie Thomasi *	Head, Legal Unit
Damtotine Tiem	Administrative Support Services Officer

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Ayénan Janvier Doumatey *	Deputy Head of Finance
Bastou Agnide Salami *	Senior Accountant
François Tosse	Senior Accountant

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Operations and Facilities Unit

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Safiatou Yabré *	Manager, Travel and Liaison
Angelito Medenilla	Procurement Officer
Hiroshi Tanaka *	Mechanic
Maryana Yuno *	Logistician Compliance

Information and Communications Technology Unit

Moussa Davou	ICT Manager
Rama S. Venkatraman	Multimedia Designer

Planning and Budget Unit

Leny Mangonon Medenilla	Budget and Planning Manager
Abdoulaye Sanwidi	Financial Information Systems Administrator
Abdellahi Cheikh Sidiya *	Accountant
Korotoumou Ouattara ‡	Principal Accountant
Awa Jarjusey *	Consultant

Research Division

Olupomi Ajayi	Risk Management Coordinator / Project Coordination Support
Mazen El Solh *	Research Operations Officer
Maïmouna Diatta	French Editor / Translator
Emmanuel Onasanya	Desktop Publishing Assistant
Fassouma Sanogo	Translator
Gisèle Dago	Secretary

Genetic Diversity and Improvement Program

Takashi Kumashiro	Program Leader
Kofi Isaac Bimpong	Molecular Geneticist – Salinity Tolerance (Senegal)
Ibnou Dieng	Biometrician
Khady Nani Dramé	Molecular Biologist (Tanzania)
Raafat El-Namaky	Hybrid Rice Breeder (Senegal)
Mamadou Fofana	Drought Physiologist (Ibadan)
Baboucarr Manneh	Irrigated Rice Breeder (Senegal)
Marie-Noëlle Ndjiondjop	Molecular Biologist, Head of Genetic Resources Unit
Kayodé Sanni ‡	Head of Genetic Resources Unit, INGER-Africa Coordinator
Saber El-Sayed Sedeek	Upland Rice Breeder (Tanzania)
Mandè Semon	Upland Rice Breeder (Ibadan)
Yacouba Séré ‡	Plant Pathologist (Tanzania)
Moussa Sié	Senior Rice Breeder, Rice Breeding Task Force Coordinator
Drissa Silué	Plant Pathologist
Negussie Shoatec Zenna	High-altitude Rice Breeder (Tanzania)
Ramaiah Venuprasad	Rainfed Lowland Rice Breeder (Ibadan)
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Sangeetha Kalimuthu Kannan *	Programmer (Tanzania)
Oluwatoyin O. Afolabi *	Research Assistant
Amakoé Délali Alognon	Research Assistant
Nana Kofi Abaka Amoah *	Research Assistant (Senegal)
Fatimata Bachabi	Research Assistant
Saidu Bah	Research Assistant
Popoola Bosede	Research Assistant (Ibadan)
Judith Hubert	Research Assistant (Tanzania)
Ghislain Kanfany	Research Assistant (Senegal)
Esther Delphine Makamte Pegalepo *	Research Assistant
Daouda Mbodj *	Research Assistant (Senegal)
Martin E. Ndomondo	Research Assistant (Tanzania)
Ayoni Ogunbayo ‡	Research Assistant
Aderonke A. Oludare *	Research Assistant
Dro Daniel Tia	Research Assistant
Felix Waweru	Research Assistant (Tanzania)
Maimounatou Niang	Bilingual Secretary

Sustainable Productivity Enhancement Program

Koichi Futakuchi	Program Leader and Crop Ecophysiologist
Susumu Abe ‡	Soil Scientist
Senthilkumar Kalimuthu	Cropping Systems Agronomist (Tanzania)
John Manful	Grain Quality Specialist
Mutsa Masiyandima	Water Management Specialist
Jonne Rodenburg	Agronomist (Tanzania)
Kazuki Saito	Rice Agronomist
Karim Traoré	Grain Quality and Seed Systems Expert (Senegal)
Pepijn van Oort	Crop Modeler
Sander Zwart	Remote Sensing and GIS Specialist
Justin Djagba	Consultant
Kodjo Soklou A. Worou	Consultant
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Mamadou Cissoko *	PDF Weed Science
Côme Agossa Linsoussi ‡	PDF Remote Sensing and GIS
Sali Atanga Ndindeng *	PDF Grain Quality and Postharvest Technology

Amos Onasanya ‡	PDF Plant Pathology (Nigeria)
Suchit Shrestha ‡	PDF Agronomy/Physiology
Atsuko Tanaka *	PDF Soil Science
Elke Vandamme *	PDF Agronomy
Cyrille Adda	Research Associate, Entomology
Abou Togola	Research Associate, Entomology (Ibadan)
Amadou Touré	Research Associate, Agronomy
Olusola Morayo Adefurin *	Research Assistant
Kokou Ahouanton	Research Assistant
Daniel Damson Elifadhili *	Research Assistant (Tanzania)
Seth Graham Acquaah	Research Assistant
Y. Jean-Martial Johnson	Research Assistant
Yaha Perpetue Kouamé	Research Assistant
Derek Makokha	Research Assistant (Tanzania)
Cesse Valère Mel	Research Assistant (Senegal)
Francis Molua Mwambo *	Research Assistant
Abibou Niang	Research Assistant
Oyetunji Olumoye *	Research Assistant (Ibadan)
Enos Onyuka ‡	Research Assistant (Tanzania)
Abdoulaye Sow	Research Assistant (Senegal)
Bonaventure January Tesha *	Research Assistant (Tanzania)
Mariama C. Dieng	Administrative Assistant
Bastatou Assani da Gloria *	Bilingual Secretary

Policy, Impact Assessment and Innovation Systems Program

Aliou Diagne	Program Leader and Impact Assessment Economist
Rita Afiavi Agboh-Noameshie	Gender Specialist, Gender Task Force Coordinator
Aminou Arouna	Agricultural Economist
Attisso Kafu-Ata Attiogbevi-Somado *	Monitoring and Evaluation Specialist
Jeanne Y. Coulibaly ‡	Policy Economist
Matty Demont ‡	Agricultural Economist (Senegal)
Rose Edwige Fiamohe	Agricultural Economist
Cara M. Raboanarielina	Social Scientist, RAP Coordinator
Jean Moreira	Consultant
Emelina Nieva Caceres Bimpong *	Data Analyst and Computer Programmer
Gaudiose Mujawamariya *	PDF Rice Value Chain (Tanzania)
Mandiaye Diagne	Research Associate (Senegal)

Esther Leah Achandi	Research Assistant (Tanzania)
Eyram Amovin-Assagba	Research Assistant
Abdoulaye Kaboré	Research Assistant
M.M. Florent Kinkingninhoun	Research Assistant
Tebila Nakelse	Research Assistant
Maïmouna Ndour	Research Assistant (Senegal)
Raboanarielina Tovonirina	Research Technician
Roselyne Houeto	Bilingual Secretary

Partnership & Capacity Strengthening Division

Samuel Bruce-Oliver	Director, Partnership & Capacity Strengthening
Issaka Yougbare	Principal Administrative Assistant
Judith Lucrece Deyo	Secretary

Regional Stations and Offices

Boubié Vincent Bado	Regional Representative in Senegal and Sahel Agronomist
Amadou M. Bèye	Representative in Côte d'Ivoire and Seed Systems Expert
Paul Kiepe	Regional Representative for East and Southern Africa (Tanzania)
Francis Nwilene	Regional Representative in Nigeria (Ibadan)
Olufisayo Atinuke Kolade	Research Administrative Manager (Ibadan)
Ali A. Touré	Agricultural Economist (Sierra Leone)
Seyi Olaoye-Williams	Executive Assistant (Ibadan)
Lansana Koroma *	Office Manager (Consultant, Sierra Leone)
Johnson Adedayo Adetumbi *	Consultant

Rice Sector Development Program

Mamadou Kabirou N'Diaye	Program Leader (Senegal)
Inoussa Akintayo	AfricaRice Projects Coordinator in Liberia
Gbenga Akinwale *	Seed Systems Specialist (Abuja)
Boubakary Cissé	Program Assistant
Mansour Diop	Research Assistant (Senegal)
Thomas Dubois	Rice Commodity Specialist
Philip Atsaboghena Idinoba *	Agronomist–Water Management Specialist (Abuja)
Hubertus Meertens *	Rice Research Coordinator (Sierra Leone)
Mobio Modeste R. N'kou	Research Assistant (Côte d'Ivoire)

Chijioke Maduka Osuji *	Rice Value Chain and Postharvest Specialist (Abuja)
Bernard Firmin Tano *	Research Assistant

Marketing & Communications Unit

Savitri Mohapatra	Head of Marketing and Communications
Dohoué Yvette Singbo Dossa	Donor Relations Assistant

Knowledge Management & Capacity Strengthening Unit

Myra Wopereis-Pura	Head, Knowledge Management & Capacity Strengthening

Collaborating Scientists

Bertrand Muller	Agro-climatologist (CIRAD, Senegal)
Joël Huat	Vegetable Agronomist (CIRAD)
Philippe Menozzi	Entomologist (CIRAD)
Seiji Yanagihara	Rice Breeder (JIRCAS)

* Joined in 2013

‡ Left in 2013

AfricaRice team members and partners

Postgraduate trainees

Name and thesis topic	Institution/ university	Country of origin	Gender	Sponsor	Degree
Agossadou, Arsene *Impact du Tarif Extérieur Commun sur l'offre, la demande du riz et sur le revenu des producteurs au Bénin*	Université d'Abomey-Calavi, Benin	Benin	M	Department of Foreign Affairs, Trade and Development (Canada)	PhD
Amayo, Robert Characterization of pathogen–host–environment relationships for *Magaporthe grisea* in Uganda	Makerere University, Kampala, Uganda	Uganda	M	Global Rice Science Scholarship (GRiSS)	PhD
Bah, Saidu Estimation of outcrossing in rice using a morphological marker	University of Free State, South Africa	The Gambia	M	CGIAR/GCP	PhD
Bama, Delphine Aissata Evaluation of N effect of legume on succeeding rainfed upland rice in West Africa savannah (Burkina Faso)	Polytechnic University of Bobo Dioulasso, Niger	Burkina Faso	F		PhD
Bilaro, Alugonza Genetic improvement of rice (*Oryza sativa*) for phosphorus deficiency tolerance	Sokoine University of Agriculture, Morogoro, Tanzania	Tanzania	M	Japan	PhD
Bissah, Matilda N. Identification of quantitative trait loci (QTLs) tolerant to salinity in rice (*Oryza sativa*) from traditional African donor and improvement of some popular varieties in Ghana	West Africa Centre for Crop Improvement (WACCI)/ University of Ghana	Ghana	F	WACCI	PhD
Dago, Faustin Effect of fertilizers on RYMV epidemic	University of Abidjan Cocody, Côte d'Ivoire	Côte d'Ivoire	M	AfDB	PhD
Danvi, Alexandre Modelling the hydrological impact rice intensification in Inland Valleys in Benin	Bonn University, Bonn, Germany	Benin	M	Japan/IRRI	PhD
Dibba, Lamin Assessing the impact of improved rice technology on household food security in The Gambia	University of Hohenheim, Germany	The Gambia	M	GRiSS	PhD
Diouf, Daba Ndour *Tolérance du riz au froid*	Université de Cheikh Anta Diop, Saint-Louis, Senegal	Senegal	F	BMGF/IRRI	PhD

Name and thesis topic	Institution/ university	Country of origin	Gender	Sponsor	Degree
Diouf, Ndeye Seynabou The impact of NERICA varieties on food security — role of gender in development strategies of rice	Université de Cheikh Anta Diop, Dakar, Senegal	Senegal	F	GRiSS	PhD
Dossa, Sylvester Molecular analyses of the interaction of rice and *Xanthomonas oryzae* pv. *oryzae* under climate change — the effect of temperature and drought	Leibniz Universität, Hannover, Germany	Benin	M	BMZ/GIZ	PhD
Duku, Confidence Ecosystem services analysis in West African Inland valleys	Wageningen University, Netherlands	Ghana	M	EU	PhD
Gaye, Sokhana Rokhaya *Approche genre dans les chaines de valeurs du riz en Afrique au Sud du Sahara : L'intégration du genre dans la chaine de valeur du riz au Sénégal*	Université Gaston Berger	Senegal	F	CGIAR/GRiSP	PhD
Gayin, Joseph Kwesi How differences in rice starch properties affect functional and nutritional properties of indigenous and improved varieties	Guelph University, Canada	Ghana	M	GRiSS	PhD
Goita, Oumarou Genetic analysis for alkalinity tolerance in rice	University of Legon, Ghana	Senegal	M	Self	PhD
Kabiri, Stella Understanding how host-parasite interactions for economically important parasitic weed species in rainfed rice are differentially affected by present and expected future environmental conditions	Wageningen University, Netherlands	Uganda	F	WOTRO	PhD
Konate, Abdourasmane Identifying morphological features and physiological processes as an integrated overall strategy for tolerance to water deficit in rainfed lowland rice	Université de Ougadougou, Burkina Faso	Burkina Faso	M	Rice CI Project	PhD

Name and thesis topic	Institution/ university	Country of origin	Gender	Sponsor	Degree
Kone, Moussa Brema *Analyse de la politique budgétaire comme facteur contribuant à l'émergence de l'agriculture en tant que moteur de la croissance économique au Mali : cas du riz à l'Office du Niger*	Institut Supérieur de Formation et de Recherche Appliquée, Mali	Mali	M	EU	PhD
Koudamiloro, Augustin *Caractérisation et étude biomoléculaire des insectes vecteurs de la panachure jaune du riz (RYMV) au Bénin. Perspective de contrôle avec l'huile de neem*	Université d'Abomey-Calavi, Benin	Benin	M	Self	PhD
Lydie, Makaya Yebas *Étude de l'adaptabilité du riz pour l'intensification de la riziculture dans différents écosystèmes de la République du Congo et perspective d'amélioration génétique*	Université d'Abomey-Calavi, Benin	DRC	F	Japan	PhD
Masongoso, Charles Joseph Characterization of wild rices in Tanzania and evaluation of the extent of gene flow from wild to cultivated and vice versa	University of Dar es Salaam, Tanzania	Tanzania	M	Self	PhD
Montcho, David *Diversité et bases génétiques des traits lies à la vigueur végétative et à l'adaptation du riz africain aux différentes conditions hydrauliques*	Université d'Abomey-Calavi, Benin	Benin	M	BMGF	PhD
Ncho, Simon A. Assessing current and future economic, social and environmental impacts of parasitic weeds in rice in SSA	University of Wageningen, Netherlands	Côte d'Ivoire	M	WOTRO	PhD
Ndaw, Faye Omar Study the salt tolerance using SSH-microarrays and genetic transmission of this character in rice	Université Cheikh Anta Diop, Dakar, Senegal	Senegal	M	GRiSS	PhD
Niang, Abibou Modeling the effect of nutrient management on rice yield in rainfed upland environment in Africa	University of Bonn, Germany	Senegal	M	GRiSS	PhD

Name and thesis topic	Institution/ university	Country of origin	Gender	Sponsor	Degree
Okechukwu, Anyaoha Genetic improvement of drought tolerance at reproductive stage in upland rice varieties (*Oryza sativa*) in Nigeria	WACCI/ University of Ghana	Nigeria	M	Japan	PhD
Onaga, Geoffrey Impact of climate change on pathogen diversity, and rice gene expression in response to *Magnaporthe oryzae*	Georg August University, Gottingen, Germany	Uganda	M	BMZ/GIZ	PhD
Oumarou, Souleymane Breeding rice (*Oryza sativa* L.) for salt tolerance in Niger	University of Legon, Ghana	Niger	M	WACCI	PhD
Partey, Samuel T. Effects of legume green manuring and biochar amendments on maintenance on green water and soil fertility indicators on rice cropping fields in Ghana	Manchester University, UK	Ghana	M	GRiSS	PhD
Sangare, Jean Rodrigue *Effets du déficit hydrique chez le riz à l'aide d'une population biparentale : paramètres agromorpho-physiologique et identification des QTLs impliqués dans la tolérance*	Université d'Abomey-Calavi, Benin	Mali	M	Japan	PhD
Santos, Carline Christelle *Analyse de l'influence des conditions agro écologiques de cultures sur la résistance du riz aux insectes de stock au Bénin et possibilité d'amélioration de la qualité par étuvage*	Université d'Abomey-Calavi, Benin	Benin	F	GRiSS	PhD
Shaibu, Abraham Application of marker assisted recurrent selection (MARS) to improve productivity in rainfed ecosystem for drought tolerance and yield potential	University of Nigeria Nsukka	Nigeria	M	CGIAR/GCP	PhD
Sikirou, Mouritala Genetic analysis of iron toxicity tolerance in rice	Université d'Abomey-Calavi, Benin	Benin	M	Japan	PhD
Souley, Issaka RYMV isolates pathotyping, serotyping and epidemiology in Niger	University of Niamey, Niger	Niger	M	Japan	PhD

Name and thesis topic	Institution/ university	Country of origin	Gender	Sponsor	Degree
Tippe, Denis Evaluation and dissemination of integrated technological packages for prevention and damage control of parasitic weeds in rainfed rice systems	Wageningen University, Netherlands	Tanzania	M	WOTRO	PhD
Togola, Abou *Bio-écologie de* Sitotroga cerealella *et* Sitophilus oryzae. *Perte quantitative et qualitative et impact économique des technologies de lutte au Bénin et dans des pays du projet CIDA*	Université de Lomé, Togo	Mali	M	CGIAR/GRiSP	PhD
Traoré, Adama *Impact de la variation pluviométrique sur la salinisation des bas-fonds côtiers et processus de leur récupération pour la riziculture*	Université Cheikh Anta Diop, Dakar, Senegal	Mali	M	CGIAR/GRiSP	PhD
Tusekelege, Hezron Kumbala M. Improvement of selected rice variety in Tanzania for bacterial leaf blight resistance using marker-assisted selection	Sokoine University of Agriculture, Morogoro, Tanzania	Tanzania	M	BMZ/GIZ	PhD
Van de Velde, Katrien Global and local food supply chains and development: The case of rice value chains in Benin	University of Leuven (KU Leuven), Belgium	Netherlands	F	CGIAR/GRiSP	PhD
Voglozin, Nohemi Eco-geographic patterns of genetic diversity of African rice, *Oryza glaberrima*, in Benin (West Africa)	University of Maryland — Baltimore County, USA	Benin	F	The Norman E. Borlaug Leadership Enhancement in Agriculture Program	PhD
Waly, Basse Blaise *Évaluation de l'impact des variétés*	Université Gaston Berger, Saint-Louis, Senegal	Senegal	M	EU	PhD
Wiredu, Alexander Nimo Impact of fertilizer subsidy program on farm-level productivity and food security: A case study of rice producers in northern Ghana	University of Hohenheim, Germany	Ghana	M	GRiSS	PhD
Zossou, Espérance E. *Soutenir la poste-récolte et le marché du riz local en Afrique de l'Ouest*	Université de Liège, Gembloux, Belgium	Benin	F	Japan	PhD

Name and thesis topic	Institution/ university	Country of origin	Gender	Sponsor	Degree
Adegbehingbe, Taiwo Felix Physiology mechanism of drought tolerance in some selected near isogenic lines	Obafemi Awolowo University, Nigeria	Nigeria	M	Bill & Melinda Gates Foundation (BMGF)	MSc
Adegbola, Nadège *Revue de politiques commerciales mise en œuvre par les exportateurs et producteurs pour atteindre l'autosuffisance : quelles leçons pour le Bénin ?*	Université d'Abomey-Calavi, Benin	Benin	F	CGIAR/GRiSP	MSc
Adewale, Adenuga Henry Assessment of the impact of adoption of rice crop improvement technologies on the productivity and multidimensional poverty index of small-scale rice farmers in Nigeria	University of Ilorin, Kwara State, Nigeria	Nigeria	M	European Community	MSc
Akoto, Hannah F. Process development and product characteristics of extruded rice (milled and parboiled), soybean snack	University of Ghana	Ghana	F	CGIAR/GRiSP	MSc
Alidou, Asouma Imourou *Analyse socio-économique selon le genre des effets de la variabilité climatique sur les ménages riziculteurs du centre et du nord-ouest du Bénin*	Université d'Abomey-Calavi, Benin	Benin	M	CGIAR/CCAFS	MSc
Ambaliou, Olounlade O. Contract farming impact on income of rice farmer: Case of Zou and Collines departments	Université d'Abomey-Calavi, Benin	Benin	M	Japan/IRRI	MSc
Antwi, Godfred An *ex-ante* analysis of the impact of improved rice post-harvest technology adoption on income of rice farming households in Ghana	University of Ghana	Ghana	M	Department of Foreign Affairs, Trade and Development (Canada)	MSc
Auxence, Akpa Kuassi *Analyse de la rentabilité financière et de l'efficacité technique des riziculteurs utilisant la technologie du sawah au Bénin : Cas des Départements du Zou et des Collines*	Université d'Abomey-Calavi, Benin	Benin	M	Japan/IRRI	MSc

Name and thesis topic	Institution/ university	Country of origin	Gender	Sponsor	Degree
Ba, Safietou Content development of rice *e*Hub from research to development	University of Canada	Senegal	F	CGIAR/GRiSP	MSc
Baba, Sidibé Evaluation of N fertilizer equivalencies of three legumes on succeeding upland rice in Finkolo	Université de Bamako, Mali	Mali	M	UEMOA	MSc
Baffour, Leonora Process development and product characterization of cowpea fortified extruded breakfast cereal from low grade rice	University of Ghana	Ghana	F	CGIAR/GRiSP	MSc
Biaou, Romaric Olaye *Mécanisation de la riziculture en Afrique subsaharienne*	Université d'Abomey-Calavi, Benin	Benin	M	Department of Foreign Affairs, Trade and Development (Canada)	MSc
Bignon, Alohoumbo Boris *Système d'innovation et dissémination des connaissances à travers les pôles de développement du secteur rizicole par l'utilisation des NTIC*	Université d'Abomey-Calavi, Benin	Benin	M	IFAD	MSc
Bizimana, Jean-Pierre Comparison of blast population structure in three blast disease hotspots in Rwanda	Makerere University, Kampala, Uganda	Rwanda	M	GIZ/BMZ	MSc
Bolufawi, Johnson Sunday Evaluation of interspecific *O. sativa* × *O. glaberrima* for resistance against root knot nematode *Meloidogyne* spp. and cyst nematode *Heterodera sacchari*	University of Ibadan, Nigeria	Nigeria	M	Japan	MSc
Coulibaly, Sokona Effect of zinc and gypsum application on rice cropping in saline soil	Université d'Abidjan, Côte d'Ivoire	Côte d'Ivoire	F	UEMOA	MSc
Damson, Daniel Elifadhili Effect of different soil fertility amendments to rice growth and yield and incidence and severity of *Rhamphicarpa*	Wageningen University, Netherlands	Tanzania	M	WUR	MSc

Name and thesis topic	Institution/ university	Country of origin	Gender	Sponsor	Degree
Dao, Karim Molecular characterization of segregating lines derived from intraspecific crosses	Université de Ougadougou, Burkina Faso	Burkina Faso	M	UEMOA	MSc
Diallo, Amadou Oury Effect of gypsum amendment, NPK, and Zn fertilization on rice grain quality in saline soil	Université de Saint-Louis, Senegal	Senegal	M	UEMOA	MSc
Diarra, Aboubacar Effect of drought on the grain yield of the MARS population and polymorphism survey on parental lines with SSR markers	Université d'Abomey-Calavi, Benin	Mali	M	CGIAR/GCP	MSc
Dossou, Emmanuel[1]	Université d'Abomey-Calavi, Benin	Benin	M	Japan	MSc
Drieu, Robin *Caractérisation de la régulation naturelle des ravageurs des céréales dans une région agricole du Bénin*	Montpellier SupAgro, France	France	M	EU	MSc
Ehirim, Bernard Screening of *Oryza glaberrima* accessions for tolerance for stagnant flooding tolerance	University of Ibadan, Nigeria	Nigeria	M	BMGF	MSc
Ekpo, Kotchikpa *Évaluation de la texture et du taux d'amylose de quelques variétés de riz cultivées au Bénin et au Sénégal*	Université d'Abomey-Calavi, Benin	Benin	M	Japan	MSc
Fatondji, Murielle Tatiana Diversity of blast population in *Oryza glaberrima* growing regions in Africa	Université d'Abomey-Calavi, Benin	Benin	F	CGIAR/GRiSP	MSc
Fatongnon, Irene Rice demand and consumer's preference in Benin	Université d'Abomey-Calavi, Benin	Benin	F	Department of Foreign Affairs, Trade and Development (Canada)	MSc
Forson, Lena A. Preference mapping and consumer demand for rice in the Accra and Kumasi metropolis	University of Ghana	Ghana	F	CGIAR/GRiSP	MSc

1. Mr Dossou passed away during his study period.

Name and thesis topic	Institution/ university	Country of origin	Gender	Sponsor	Degree
Gossens, Johanna Analysis of the influence of pedo-climate on leaf-vegetable traditional cropping in the frame of crop diversification of rice-cropping systems — Benin	Haute École Spécialisée de Suisse occidentale	Switzerland	F	HES-SO school scholarship	MSc
John, Constantine Effects of *Striga asiatica* and *Rhamphicarpa fistulosa* densities on yielding ability of rice	Sokoine University of Agriculture, Morogoro, Tanzania	Tanzania	M	CGIAR/CCAFS	MSc
Jomanga, Kennedy Elisha Effect of *Rice yellow mottle virus* on performance of different rice genotypes	Sokoine University of Agriculture, Morogoro, Tanzania	Tanzania	M	Self	MSc
Jütten, Thomas Hydrological modelling and scenario analysis	Bonn University, Germany	Germany	M	Self	MSc
Kaboyo, Solomon Barungi Distribution and population structure of *M. grisea* in Uganda	Makerere University, Kampala, Uganda	Uganda	M	BMZ/GIZ	MSc
Kalisa, Alain Distribution and population structure of *M. grisea* in Rwanda	Makerere University, Kampala, Uganda	Rwanda	M	BMZ/GIZ	MSc
Kolawole, Ajileye Analysis of NERICA varieties for resistance to *Rice yellow mottle virus*	University of Ibadan, Nigeria	Nigeria	M	Japan	MSc
Kondayen, Arsene *Création variétale et amélioration génétique des plantes*	Université d'Abomey-Calavi, Benin	CAR	M	Japan	MSc
Kossi, Kini Pathotyping of isolates of *Pantoea* sp., RYMV and screening for resistance of selected rice accessions in Togo	Université de Ouagadougou, Burkina Faso	Togo	M	Japan	MSc
Maganga, Reinfrid Martin Analysis of population structure of *M. grisea* and cultivar resistance in three major rice growing regions of Tanzania	Sokoine University of Agriculture, Morogoro, Tanzania	Tanzania	M	BMZ/GIZ	MSc

Name and thesis topic	Institution/ university	Country of origin	Gender	Sponsor	Degree
Metogbe, Aisse Ahogbeme Characterisation of types of milled rice merchandised on some markets in southern Benin	Université d'Abomey-Calavi, Benin	Benin	F	BMGF	MSc
Michodjehoun, Clementine *Étude des caractères génétiques des lignées de riz obtenues par marqueurs moléculaires*	Université d'Abomey-Calavi, Benin	Benin	F	CGIAR/GRiSP	MSc
Mkanthama, Joseph A farmer participatory evaluation of good agricultural practices (GAP) in rice production in Tanzania	Jomo Kenyatta University of Agriculture and Technology, Kenya	Malawi	M	AGEC	MSc
Modupe S., Hussein Physiology mechanism of drought tolerance in some lowland rice varieties at both vegetative and reproductive stages	Federal University of Agriculture Abeokuta, Nigeria	Nigeria	F	Self	MSc
Montcho, Karel Isidore *Influence du temps de récolte sur les propriétés d'usinage, les caractéristiques physico-chimiques et culinaires de certaines variétés de riz* O. glaberrima	Université d'Abomey-Calavi, Benin	Benin	M	Japan	MSc
Msangi, Saidi Hamadi Effects of *Striga asiatica* and *Rhamphicarpa fistulosa* densities on yielding ability of rice	Sokoine University of Agriculture, Morogoro, Tanzania	Tanzania	M	CGIAR/CCAFS	MSc
Mwenda, Mesharck Analysis of population structure of bacterial leaf blight and cultivar resistance in three major rice growing regions of Tanzania	Sokoine University of Agriculture, Morogoro, Tanzania	Tanzania	M	BMZ/GIZ	MSc
Ndougonna, Ramal C. *Détermination des caractères physico-chimiques et caractères multiples des ARICA*	École d'ingénieur chimiste généraliste de Compiègne, France	Chad	F	Japan	MSc

Name and thesis topic	Institution/ university	Country of origin	Gender	Sponsor	Degree
Nikolaus, Bjorn Rice production in Africa — Simulation of rice production and water productivity using AquaCrop in an inland valley in central Benin	Kiel University, Germany	Germany	M	Self	MSc
Olajide, Ajewole Oluwafemi Engendering rice research and innovation for poverty alleviation and development in Nassarawa	University of Ilorin, Kwara State, Nigeria	Nigeria	M	CGIAR/GRiSP	MSc
Olayemi, Oladedji O. Analysis of adoption patterns and constraints to adoption of rice varieties by rice framers in Nigeria	University of Ibadan, Nigeria	Nigeria	F	CGIAR/GRiSP	MSc
Oluwaseun, Popogbe Physiology mechanism of drought tolerance in some upland rice varieties at both reproductive and vegetative stages	Federal University of Agriculture Abeokuta, Nigeria	Nigeria	F	Self	MSc
Ongom, Joel Pathogenic diversity of *Xanthomonas oryzae* pv. *oryzae* in Uganda and reaction of rice germplasm to the pathogen	Makerere University, Kampala, Uganda	Uganda	M	BMZ/GIZ	MSc
Rasheedat, Olatundji A. [Did not complete]	University of Ibadan, Nigeria	Nigeria	F	Japan	MSc
Raymaekers, Karen Preference evaluation of small farmers towards fair trade contracts: A choice experiment in Benin	University of Leuven (KU Leuven), Belgium	Belgium	F	CGIAR/GRiSP	MSc
Rodrigue, Adjibogoun *Qualité des semences et des grains de lignées améliorées pour la résistance au virus de la panachure jaune du riz (RYMV)*	Université d'Abomey-Calavi, Benin	Benin	M	CGIAR/GCP	MSc
Setonde, Miguel Zavonon Non-academic training	Université d'Abomey-Calavi Benin	Benin	M	BMGF	MSc
Sodjinou, Bienvenu *Performance de la chaîne de commercialisation du riz local au nord Bénin*	Université d'Abomey-Calavi, Benin	Benin	M	Department of Foreign Affairs, Trade and Development (Canada)	MSc

Name and thesis topic	Institution/ university	Country of origin	Gender	Sponsor	Degree
Toke, Ntam Fidelis Analysis of livelihood strategies for rice growers in times of climate change: Case of the Mbam Bassin and Ndop Plain in Cameroon	University of Dshang, Cameroon	Cameroon	M	CGIAR/CCAFS	MSc
Yapi, Noëlle Vanessa Use of SSR markers to evaluate genetic diversity and prediction of heterosis of hybrid rice in Senegal	Université d'Abidjan, Côte d'Ivoire	Côte d'Ivoire	F	UEMOA	MSc
Yelome, Octaviano Igor Assessment of the extent and damage of a newly identified rice leaf blight caused by *Pantoea ananatis* in Benin and breeding for disease resistance for an efficient management of epidemics	Université d'Abomey-Calavi, Bénin	Benin	M	Japan	MSc
Zongo, Nongawende Ella Study of nitrogen use efficiency by rice in saline soil	Université de Ougadougou, Burkina Faso	Burkina Faso	F	UEMOA	MSc

AfricaRice training programs

Training courses conducted by AfricaRice in 2013

Theme	Location and dates	Men	Women	Total number of participants
Practical on variety trial for research technicians	Kampala 8–12 April	15	3	18
Advanced qualitative data analysis using NVivo for the diagnostic survey research	Cotonou 29 April to 4 May	13	2	15
Project fund management and reporting for NARS Administration and Finance Officers	Cotonou 29–31 May	17	4	21
La gestion intégrée des opérations récolte et post récolte du riz	Saint-Louis 24 June to 5 July	10	3	13
Knowledge exchange in the rice hubs	Cotonou 26–28 June	9	3	12
Area survey and crop cutting	Cotonou 3–9 July	7	3	10
Sensory and evaluation	Cotonou 2–6 September	7	3	10
Farmer-to-farmer video training	Kumasi 22–25 July	40	3	43
Media training	Yaoundé 19 October	12	3	15
Value addition and processing of rice-based products	Cotonou 19–22 February	12	23	35
Gender in rice research and technology development	Cotonou 6–10 May	9	24	33
Yield gap and productivity monitoring methodology	Cotonou 22–24 April	4	0	4
Automated monitoring and evaluation (M&E) system	Cotonou 22–23 August	8	0	8
Dot sampling	Cotonou 25–29 March	34	10	44
Techniques améliorées de culture de riz de bas-fond	Kara, Togo 9–20 December	23	2	25
Thresher–cleaner (ASI) construction	Ilorin, Nigeria 4–16 December	29	0	29
Mlax survey application for baseline data collection at country level	18 in-country courses	192	48	240

Theme	Location and dates	Men	Women	Total number of participants
Production et commercialisation des semences du riz	Saint-Louis 18 January to 8 February	12	2	14
Gestion des nutriments en riziculture	Saint-Louis 8–12 April	17	1	18
Rice production techniques	Liberia	33	10	43
Postharvest training	Liberia	21	6	27
Harvest and postharvest technology	Saint-Louis 24 June to 4 July	10	3	13
Quality rice production	Ganta City, Liberia 20–22 June	68	15	83
Better water quality management	Liberia	33	10	43
Totals		**635**	**181**	**816**

Publications*

Papers published in peer-reviewed journals

Awotide BA, Karimov A, **Diagne A** and **Nakelse T**. 2013. The impact of seed vouchers on poverty reduction among smallholder rice farmers in Nigeria. *Agricultural Economics*, 44(6): 647–658. DOI: 10.1111/agec.12079.

Ballogou VY, Sagbo FS, Soumanou MM, **Manful JT**, Toukourou F and Hounhouigan JD. 2013. Effect of processing method on physico-chemical and functional properties of two fonio (*Digitaria exilis*) landraces. *Journal of Food Science and Technology*, DOI: 10.1007/s13197-013-1150-4.

Barbiroli A, Bonomi F, Casiraghi MC, Iametti S, Pagani MA and Marti A. 2013. Process conditions affect starch structure and its interactions with proteins in rice pasta. *Carbohydrate Polymers*, 92: 1865–1872.

Chougourou DC, **Togola A**, **Nwilene FE**, Adeliossi J, Bachabi F and Oyetunji OE. 2013. Susceptibility of some rice varieties to the lesser grain borer, *Rhyzopertha dominica* Fab (Coleoptera: Bostrichidea) in Benin. *Journal of Applied Sciences*, 13: 173–177. DOI: 10.3923/jas.2013.

Collard BCY, Septiningsih EM, Das SR, Carandang JJ, Pamplona AM, Sanchez DL, Kato Y, Ye G, Reddy JN, Singh US, Iftekharuddaula KM, **Venuprasad R**, Vera-Cruz CN, Mackill DJ and Ismail AM. 2013. Developing new flood-tolerant varieties at the International Rice Research Institute (IRRI). *SABRAO Journal of Breeding and Genetics*, 45(1): 42–56.

Demont M. 2013. Reversing urban bias in African rice markets: A review of 19 national rice development strategies. *Global Food Security*, 2: 172–181.

Demont M and Stein AJ. 2013. Global value of GM rice: A review of expected agronomic and consumer benefits. *New Biotechnology*, 30(5): http://dx.doi.org/10.1016/j.nbt.2013.04.004.

Demont M and Stein AJ. 2013. Global value of GM rice: A review of expected agronomic and consumer benefits. *New Biotechnology*, http://dx.doi.org/10.1016/j.nbt.2013.04.004.

Demont M, **Ndour M** and **Zossou E**. 2013. Le riz africain peut-il être compétitif ? Une analyse de la compétitivité-qualité par la méthode des enchères expérimentales. *Cahiers Agricultures*, 22(5): 345–352. DOI: 10.1684/agr.2013.0664.

Demont M, Rutsaert P, **Ndour M** and Verbeke W. 2013. Reversing urban bias in African rice markets: Evidence from Senegal. *World Development*, 45: 63–74.

Demont M, Rutsaert P, **Ndour M**, Verbeke W, **Seck PA** and Tollens E. 2012. Experimental auctions, collective induction and choice shift: Willingness-to-pay for rice quality in Senegal. *European Review of Agricultural Economics*, 40(2): 261–286.

Devos Y, Dillen K and **Demont M**. 2013. How can flexibility be integrated into coexistence regulations? A review. *Journal of the Science of Food and Agriculture*, DOI: 10.1002/jsfa.6358.

Diagne M, **Demont M**, **Seck PA** and Diaw A. 2013. Self-sufficiency policy and irrigated rice productivity in the Senegal River valley. *Food Security*, 5: 55–68.

*The names of Africa Rice Center (AfricaRice) authors are shown in bold

Dillen K, **Demont M**, Tillie P and Rodriguez Cerezo E. 2013. Bred for Europe but grown in America: the case of GM sugar beet. *New Biotechnology*, 30(2): 131–135.

Diwani TN, Asch F, Becker M and **Mussgnug F**. 2013. Characterizing farming systems around Kakamega Forest, western Kenya, for targeting soil fertility–enhancing technologies. *Journal of Plant Nutrition and Soil Science*, 176(4): 585–594. DOI: 10.1002/jpln.201200036.

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Abbreviations

AAFEX	Association Afrique agro export
AAS	African Academy of Sciences
AASW	Africa Agriculture Science Week
ABC	agricultural business center
ACP	African, Caribbean and Pacific group of states
ADRAO	AfricaRice (old acronym in French)
AFAO	Association des femmes de l'Afrique de l'Ouest
AFD	Agence française de développement
AfDB	African Development Bank
AfricaRice	Africa Rice Center
AGRA	Alliance for a Green Revolution in Africa
AGEC	Agricultural Economics (Texas A&M University, USA)
AIDP	Agriculture and Infrastructure Development Project
ANADER	Agence nationale d'appui au développement rural (Côte d'Ivoire)
ANR	Agence national de la recherche (France)
ANSTS	Académie nationale des sciences et techniques du Sénégal
APESS	Association pour la promotion de l'élevage au Sahel et en Savane
APO	Assistant Professional Officer
ARI	African Rice Initiative
ARICA	Advanced Rice for Africa (varieties)
ASI	ADRAO–SAED–ISRA thresher–cleaner
ATAT	Agricultural Transformation Agenda Thresher (Nigerian 'ASI' thresher–cleaner)
BADEA	Arab Bank for Economic Development in Africa
BBSRC	Biotechnology and Biological Sciences Research Council
BMGF	Bill & Melinda Gates Foundation
BMZ	Federal Ministry for Economic Cooperation and Development (Germany)
BOAD	Banque ouest africaine de développement
CAADP	Comprehensive Africa Agriculture Development Programme
CAAS	Chinese Academy of Agricultural Sciences
CAR	Central African Republic
CARD	Coalition for African Rice Development
CCAFS	Climate Change, Agriculture and Food Security (CRP)
CEO	chief executive officer
CET	common external tariff
CFC	Common Fund for Commodities
CI	Challenge Initiative
CIAT	International Center for Tropical Agriculture
CIFOR	Center for International Forestry Research

CILSS	Permanent Interstate Committee for Drought Control in the Sahel (Comité permanent inter-états de lutte contre la sécheresse dans le Sahel)
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement (France)
CNRA	Centre national de recherche agronomique (Côte d'Ivoire)
CORAF/WECARD	Conseil ouest et centre africain pour la recherche et le développement agricoles (French for WECARD)
CRP	CGIAR Research Program
CSIR	Council for Scientific and Industrial Research
DFID	Department for International Development (UK)
DGPSA	Direction générale des productions et de la sécurité alimentaire (Côte d'Ivoire)
DIIVA	Diffusion and Impact of Improved Crop Varieties in Africa (project)
doi	digital object identifier
DRC	Democratic Republic of Congo
DRDR	Direction régionale du développement rural (Senegal)
DPC	Directorate for Partnership and Capacity Strengthening (AfricaRice)
ECOWAS	Economic Community of West African States
ed.	editor
eds	editors
ESCAPE	Changements environnementaux et sociaux en Afrique : passé, présent et futur
EU	European Union
F	female
FAO	Food and Agriculture Organization of the United Nations
FARA	Forum for Agricultural Research in Africa
FAT	Farmer Adoption Trial (Africa-wide Rice Breeding Task Force)
FIRCA	Fonds interprofessionel pour la recherche et le conseil agricoles (Côte d'Ivoire)
FTF	Feed the Future
GADCO	Commercial rice producer in Ghana
GAP	good agricultural practices
GCP	Generation Challenge Program (CGIAR)
GIS	geographic information systems(s)
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GlobE	Global Food Security
GRiSP	Global Rice Science Partnership
GRiSS	Global Rice Science Scholarship
GYGA	Global Yield Gap Atlas
G×E	genotype × environment
HES-SO	Haute école spécialisée de Suisse occidentale (University of Applied Sciences and Arts Western Switzerland)
IAR	Institute for Agricultural Research (Nigeria)
IBRD	International Bank for Reconstruction and Development (World Bank)

ICARDA	International Center for Agricultural Research in the Dry Areas
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICT	information and communications technology
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IHP	Interspecific Hybridization Project
IITA	International Institute of Tropical Agriculture
INGER	International Network for the Genetic Evaluation of Rice
INPHB	Institut national polytechnique Félix Houphouët-Boigny (Côte d'Ivoire)
INRAB	Institut national de recherches agricoles du Bénin
IRAD	Institute of Agricultural Research for Development (Cameroon)
IRD	Institut de recherche pour le développement (France)
IRM	integrated rice management
IRRI	International Rice Research Institute
ISRA	Institut sénégalais de recherches agricoles (Senegal)
JICA	Japan International Cooperation Agency
JIRCAS	Japan International Research Center for Agricultural Sciences
LABOSEM	Laboratoires de semences
LARES	Laboratoire d'analyse régionale et d'expertise sociale
M	male
M&E	monitoring and evaluation
MAFF	Ministry of Agriculture, Forestry and Fisheries (Japan)
MAFSC	Ministry of Agriculture, Food Security and Cooperatives (Tanzania)
MARI	Mikocheni Agricultural Research Institute (Tanzania)
MARKETS	Maximizing Agricultural Revenues and Key Enterprises in Targeted Sites (USAID project)
MARS	marker-assisted recurrent selection
MAS	marker-assisted selection
MESRS	Ministère de l'éducation supérieure et de la recherche scientifique (Côte d'Ivoire)
MET	Multi-Environment Trial (Africa-wide Rice Breeding Task Force)
MICCORDEA	Mitigating the Impact of Climate Change on Rice Disease Resistance in East Africa
MISU	Michigan State University
MOFA	Ministry of Foreign Affairs (Japan)
MSc	Master of Science (postgraduate degree)
Mt	million tonnes
NARES	national agricultural research and extension service(s)
NARO	National Agricultural Research Organisation (Uganda)
NARS	national agricultural research system(s)
NCAM	National Centre for Agricultural Mechanization (Nigeria)

NCRI	National Cereals Research Institute (Nigeria)
NEPAD	New Partnership for Africa's Development
NERICA	New Rice for Africa (family of interspecific rice varieties for uplands)
NERICA-L	New Rice for Africa (family of interspecific rice varieties for lowlands)
NGO	non-governmental organization
NIAS	National Institute of Agrobiological Sciences (Japan)
NIRSAL	Nigeria Incentive-based Risk Sharing for Agricultural Lending
NPCA	NEPAD Planning and Coordinating Agency
NRDS	national rice development strategy
NTIC	nouvelles technologies de l'information et de la communication (i.e. ICT)
ONDR	Office national pour le développement de la riziculture (Côte d'Ivoire)
P	phosphorus
PACER-UEMOA	Programme d'appui et de développement des centres d'excellence régionaux au sein de l'UEMOA (Support and development program of regional centers of excellence in UEMOA)
PADER	Programme d'appui au développement rural
PARASITE	Preparing African rice farmers against parasitic weeds in a changing environment
PAT	Participatory Advanced Trial (Africa-wide Rice Breeding Task Force)
PDF	Post-Doctoral Fellow
PET	Participatory Environmental Trial (Africa-wide Rice Breeding Task Force)
PhD	Doctor of Philosophy (doctoral degree)
PNAR	Programme national d'autosuffisance en riz (Senegal)
POSCAO	Plateforme des organisations de la société civile de l'Afrique de l'Ouest sur l'accord de Cotonou
PSTOL1	*phosphorus starvation tolerance 1* gene
Pup1	*phosphorus uptake 1* gene
PVS	participatory varietal selection
QTL	quantitative trait locus
R&D	research and development
RAP	Realizing the agricultural potential of inland valley lowlands in sub-Saharan Africa while maintaining their environmental services
RARC	Rokupr Agricultural Research Centre (Sierra Leone)
RBM	Réseau Billital Maroobé
REPAD	Réseau de recherche pour l'appui au développement de l'Afrique
RH	relative humidity
RISING	Research in Sustainable Intensification for the Next Generation
ROCARIZ	West and Central Africa Rice Research and Development Network
ROPPA	Network of Farmers' and Agricultural Producers' Organizations of West Africa
RTA	Rice Transformation Agenda (Nigeria)
RYMV	*Rice yellow mottle virus*
SAED	Société nationale d'aménagement et d'exploitation des terres du Delta et des vallées du fleuve Sénégal et de la Falémé (Senegal)

SARD-SC	Multinational CGIAR Support to Agricultural Research for Development on Strategic Commodities in Africa (project)
SCPRID	Sustainable Crop Production Research for International Development (project)
SLARI	Sierra Leone Agricultural Research Institute
SMART-IV	Sawah, Market Access and Rice Technologies for Inland Valleys
SNV	Netherlands Development Organisation
SODAGRI	Société de développement agricole et industriel (Senegal)
SSH	Suppression Subtractive Hybridization
SSR	simple sequence repeat
STRASA	Stress Tolerant Rice for Poor Farmers in Africa and South Asia
SUA	Sokoine University of Agriculture
TICAD	Tokyo International Conference on African Development
UEMOA	West African Economic and Monetary Union (Union économique et monétaire Ouest Africaine)
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
US	United States
US$	US dollars
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
VAT	Validation AfricaRice Trial (Africa-wide Rice Breeding Task Force)
VECO	Organisation non gouvernementale internationale Vredeseilanden
WAAPP	West Africa Agricultural Productivity Program (World Bank)
WACCI	West Africa Centre for Crop Improvement (Ghana)
WECARD	West and Central African Council for Research and Development
WILDAF	Women in Law and Development in Africa
WOTRO	Netherlands Organisation for Scientific Research – Research for Global Development
WUR	Wageningen University and Research Centre (Netherlands)

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CGIAR is a global partnership that unites organizations engaged in research for a food secure future. CGIAR research is dedicated to reducing rural poverty, increasing food security, improving human health and nutrition, and ensuring more sustainable management of natural resources. It is carried out by the 15 centers who are members of the CGIAR Consortium in close collaboration with hundreds of partner organizations, including national and regional research institutes, civil society organizations, academia, and the private sector.

For more information, visit: www.cgiar.org

The Centers

AfricaRice	Africa Rice Center (Cotonou, Benin)
Bioversity	Bioversity International (Rome, Italy)
CIAT	International Center for Tropical Agriculture (Cali, Colombia)
CIFOR	Center for International Forestry Research (Bogor, Indonesia)
CIMMYT	International Maize and Wheat Improvement Center (Mexico, DF, Mexico)
CIP	International Potato Center (Lima, Peru)
ICARDA	International Center for Agricultural Research in the Dry Areas (Beirut, Lebanon)
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics (Patancheru, India)
IFPRI	International Food Policy Research Institute (Washington, DC, USA)
IITA	International Institute of Tropical Agriculture (Ibadan, Nigeria)
ILRI	International Livestock Research Institute (Nairobi, Kenya)
IRRI	International Rice Research Institute (Los Baños, Philippines)
IWMI	International Water Management Institute (Colombo, Sri Lanka)
World Agroforestry	World Agroforestry Centre (Nairobi, Kenya)
WorldFish	WorldFish Center (Penang, Malaysia)

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