

Rice research in the development of livelihoods and sustainable food value chains in Africa

Manneh B, Jalloh A, Arouna A, Africa Rice Centre

Rice is the second most important crop after wheat in fighting undernutrition in Africa, with more than 100 million livelihoods depending on it. However, despite the 20 million smallholder farmers producing rice on the continent, Africa is still not self-sufficient. In 2022–2023, total rice imports were 17 million metric tons (MT) out of a total consumption of 38 million MT.

The Africa Rice Centre (AfricaRice) is a pan-African Centre of Excellence for rice research, development and capacity building, with a membership of 28 African countries. The vision of AfricaRice is to sustainably improve food and nutrition security for a healthy and prosperous Africa. It contributes to reducing poverty, achieving food and nutrition security and improving livelihoods of farmers and other rice value chain actors in Africa by increasing the productivity and profitability of rice-based agri-food systems, while ensuring the

sustainability of natural resources. Thanks to its partners and donors, AfricaRice invested a cumulative total of US\$ 373.66 m between 1998 and 2020. The majority of these investments were used to develop and disseminate innovative technologies and knowledge to boost local rice production and reduce the gap between domestic supply and demand. AfricaRice is committed to achieving the United Nations Sustainable Development Goals (SDGs). Within the framework of the One CGIAR, AfricaRice is addressing 9 of the 17 SDGs, namely SDG 1, 2, 3, 4, 5, 6, 8, 9, 12, 13, 15 and 17.

Increasing access to climate-resilient, productive and consumer-preferred rice

AfricaRice and its partners have developed and released about 570 high-yielding and climate-resilient varieties over the years. Since the first release in the early 2000s, New Rice for Africa (NERICA) varieties have revolutionized rice production



A farmer manually harvesting one of AfricaRice's improved varieties

on the continent. NERICA varieties are the first large-scale successful use of a variety developed from the cross of the two cultivated rice species: *Oryza sativa*, known as Asian rice, and *O. glaberrima*, often called African rice and found only in Africa.

NERICAs are now the most widely adopted upland rice varieties in sub-Saharan Africa and are grown in more than 16 countries. The area under NERICA cultivation increased from 200,000 ha in 2008 to 1.4 m ha in 2013, and 2.1 m ha in 2021. The estimated yield gain is 0.32 MT/ha. By adopting improved rice varieties developed by AfricaRice and its partners, about 8m people in 16 countries in Africa have been lifted out of poverty (SDG 1) and about 7.2m people have been lifted out of food insecurity (SDG 2). The success of the NERICA varieties has now expanded beyond the African continent. The NERICAs are being used by farmers for rice production and by breeders in varietal improvement programmes in Bangladesh, China, India and several other countries around the world.

In 2022, two key projects led by AfricaRice also contributed to SDG 1 by increasing rice productivity through the scaling of seeds of improved varieties. Through the COVID-19 response rice seed (CORIS) project funded by the German Government, AfricaRice and national research institutes supplied 24.8 MT of breeder seed, from which the national research institutes and seed companies produced 934 MT of foundation seed. Seed companies and farmer cooperatives used the foundation seeds to deliver 28,167 MT of certified seed in 2022. The CORIS project has directly benefited 11,310 seed producers with 85.6 per cent being youth and 10 per cent being female (contributing to SDG 5 and SDG 8). In total, an estimated 845,494 seed producers, field workers and their families benefited from the production of seeds in Côte d'Ivoire, Benin, Nigeria, Burkina Faso and Mali. The indirect beneficiaries of the project were estimated at 72,000 value chain actors and 1.8 m farm workers and consumers. By extrapolation, the project should effectively deliver 475,200 MT of milled rice. Similarly, the Seed Scaling project funded by USAID supported consortium members in year 2021 to produce 5,574 MT of seed in Senegal. The project has increased private sector access to breeder and foundation seeds of new climate-smart varieties, empowered the private sector to increase market share of certified seeds and increased farmer access to quality seeds to improve yields. Overall, the project has reached 624 women in 6 women groups out of 1526 seed producers (41 per cent) during the last implementation period (contributing to SDG 5).

Enhancing productivity and incomes of farmers

Despite the significant progress made in producing and disseminating improved high yielding and market driven rice varieties, average rice yields in Africa are 2.1kg/ha. There is thus a growing need to ensure that the full potential of these varieties is realized in the various rice production systems on the continent. This need has become more urgent in the face of climate change and rapid population growth. Fortunately, AfricaRice and its partners have already identified some key technologies and innovations that have made an impact on increasing rice productivity and production on the continent.

Smart-valleys is a low-cost, participatory and sustainable approach to develop the bottoms of inland valleys for



Image: Africa Rice Centre

Farmers being shown a drainage mechanism associated with the smart valley innovation

rice-based systems. This innovation has been implemented in Benin, Burkina Faso, Liberia, Sierra Leone and Togo and has significantly reduced the constraints associated with lowland rice production. It increases the humidity of plots by 12 per cent (contributing to SDGs 6 and 15) throughout the growing cycle and enables farmers to increase their rice yield by 0.9 MT/ha which is 21 per cent of yields under farmers' normal practice. This translates to a net income gain of US\$ 267 per ha. Due to his work on the out-scaling of Smart valleys technology with farmers in West Africa, AfricaRice scientist, Dr Elliott Dossou-Yovo, received the Norman Borlaug Award for Field Research and Application in 2021.

RiceAdvice is a decision support tool developed by AfricaRice and partners. It is an Android-based application providing customized, field-level recommendations for fertilizer management, including which fertilizers to use, when and at what application rates. Farmers applying RiceAdvice recommendations were able to increase their yields by 20 per cent (730 kg/ha) over the control, achieving a 23 per cent increase in profit, i.e. US\$ 275/ha. In 2016 alone, 8,115 farmers benefited from RiceAdvice, generating an additional production of 7,625 MT of rice worth US\$ 3.7m (contributing to SDG 12).

Integrated Rice-Fish Farming Systems (IRFFS) function by integrating rice production and fish farming. The adoption of the system has increased annual fish production in Liberia by 16 MT in 2020 and by 39 MT in 2021. The project informed almost 3,200 farmers about the results of the integrated rice-fish farming systems. About 155 households, mostly comprising women and youth, are involved in the rice-fish system production practices, representing a 35 per cent increase in 2021 compared to 2020 (contributing to SDGs 5 and 8).

Developing and promoting efficient, labour-saving technologies and value addition

Threshing

Manual rice threshing is labour intensive and traditionally performed by women. Its inefficiency creates post-harvest losses of up to 35 per cent and, for that reason, AfricaRice and partners have developed an improved rice thresher (ASI). Farmers using the technology can achieve a high threshing capacity of 6–7 MT of paddy rice per day compared to one MT with manual threshing. Use of the thresher can also reduce

fuel costs and achieve a grain-straw separation rate of 99 per cent. It is now being used in 19 African countries. More than 50 per cent of the total paddy produced in Senegal is threshed with the ASI thresher. By replacing traditional threshing technologies producers can attain an average gain of US\$ 53 per ha. Since its first introduction in Senegal in 1997, the number of machines manufactured locally has increased steadily, reaching almost 3,000 in 2021. This represents an investment of about US\$ 12m. The area coverage (where farmers have access to the technology) was estimated at 31 per cent of the total in 2008, growing to 77 per cent in 2021, with the ASI machine threshing paddy over an estimated area of 1.8m ha (contributing to SDG 9).



Image: Africa Rice Centre

Rice-Fish farming plot in Liberia

Parboiling

Parboiling improves the physicochemical and nutritional properties of rice, and hence provides an avenue for not only improving nutrition for households but also an income-generating opportunity for women, when sold on the market. However, the traditional parboiling process (conducted mostly by women) is laborious, time-consuming and unsafe, producing rice with impurities, broken and burnt grains, and an undesirable smell. It also requires large quantities of firewood and water, negatively impacting the environment.

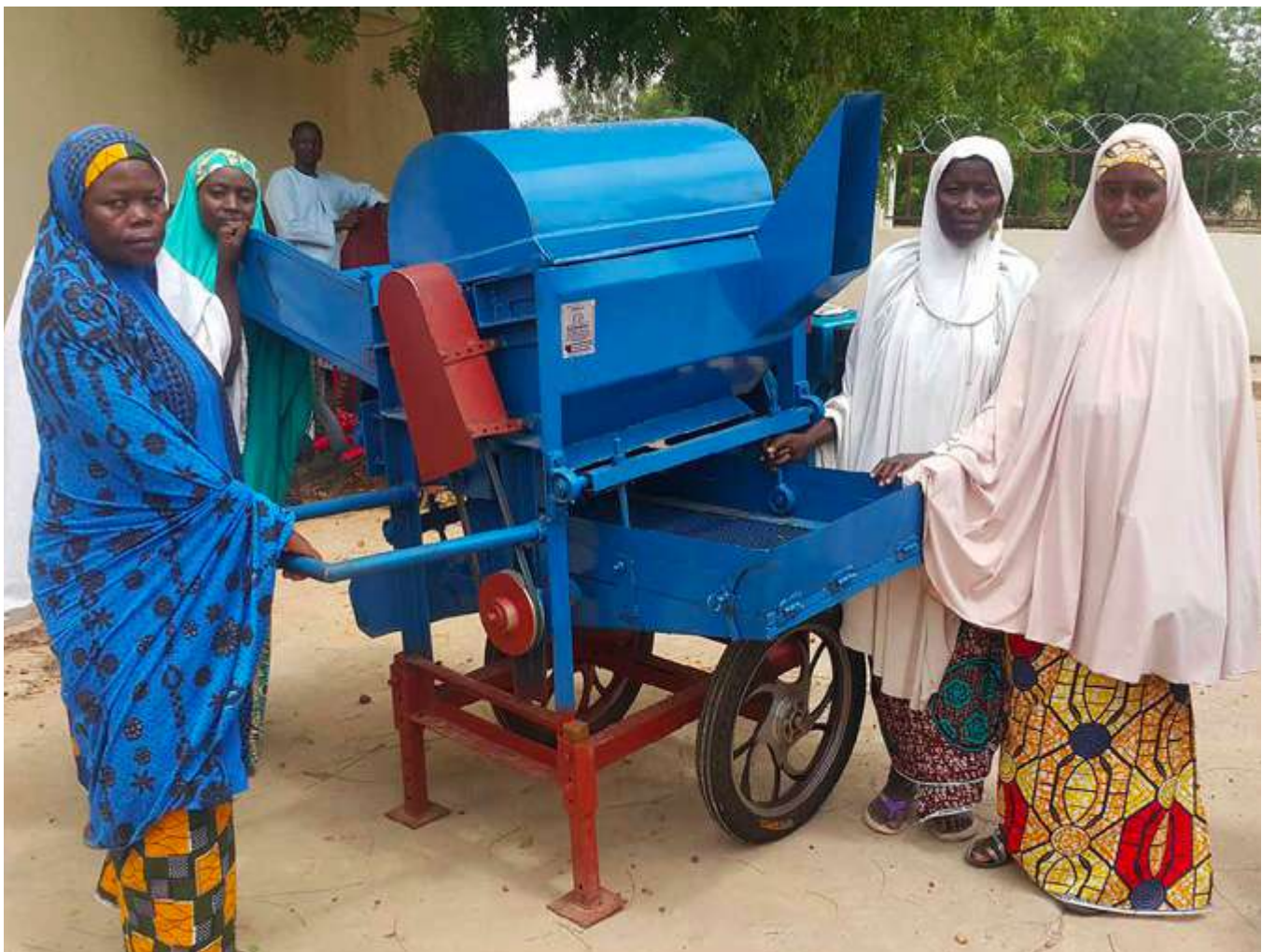


Image: Africa Rice Centre

Women proudly posing with a new ASI thresher



Image: Africa Rice Centre

A GEM parboiler being operated by women

AfricaRice and its partners have developed an improved rice parboiling technology called GEM and Mini-GEM. This produces better quality, more marketable rice and improves work safety for the parboilers. Women using GEM for parboiling gained an extra US\$ 72.5 per MT of parboiled rice relative to those using traditional approaches. GEM also significantly reduces or completely eliminates the need for firewood fuel, thereby saving US\$ 30/MT in the cost of firewood in the parboiling process (contributing to SDGs 13 and 15). Through the scaling of the Mini-GEM parboiling innovation package in Côte d'Ivoire, Mali, Madagascar, and Senegal about 1,000 MT of micronutrient-dense and lower glycemic index rice were produced and sold to 42,500 consumers (contributing to SDG 3). Through the ESA Parboil project, 5 women groups comprising 32 associations received parboiling units including 537 women in Madagascar who were directly trained in the process, with the benefits extending to over 3,400 women and men. In Mozambique, 3 women's associations received parboiling units and 432 women in 12 associations were directly trained and the benefits extended to over 2,300 women and men (contributing to SDGs 3, 4, 5 and 17).

Strengthening the capacity of stakeholders

AfricaRice views capacity building as a cornerstone of the process of developing and strengthening the skills, abilities, processes and resources of its national partners, including the private sector, to ensure a food-secure Africa. Between 1971 and 2019, AfricaRice and partners have provided group training and long-term degree training to a total of 43,264 people, thereby improving their skills and knowledge. This includes 1,319 next-generation rice scientists, who have been empowered through individual training between 1971 and 2020 (contributing to SDG 4).

As part of a project to promote youth entrepreneurship and job creation in West Africa's rice valley chain (RVC), from 2018 to 2020, some 310 young people from Mali and Senegal were sensitized on business opportunities in the RVC and about 215 of those were trained in entrepreneurship and technical skills, and information and communications technology (ICT) for agribusiness. Among these were 126 representatives of youth groups who reported back and passed on the training materials, reaching an additional 8,666 youth (contributing to SDG 8).

A total of 12,831 paddy growers, 65 community-based seed producers, 68 lead farmers and 115 agricultural extension agents were trained on good agricultural practices, seed production and farmer-to-farmer and extension-farmer services within the framework of the Zero Hunger Project in Nigeria (contributing to SDG 4).

The AfricaRice/IBP project (Enhancing institutional breeding capacity in Ghana, Senegal and Uganda to develop climate resilient crops for African smallholder farmers (EBCA) is a project funded by IFAD. The project has supported more than 990 participatory variety selection (PVS) trials. Engagement with seed companies and farmer associations has been remarkable, with 157 in total (22 private companies and 135 seed producer associations). The project has made significant achievements across its crops and geographies. The project has supported 7 PhD students (4 female, 3 male) and 16 MSc students (5 female, 11 male). Similarly, a total of more than 200 MSc students across the 3 countries have been exposed to, and are fluent with, the use of the BMS software as part of their curriculum. The project has also provided important ICT equipment and field infrastructure across those countries.