InfoNote

Facilitating the scaling of climate-smart technologies and innovations in rice value chains in West Africa

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Key messages

- Rice (Oryza sativa L.) is a food a key crop in West Africa, yet the production is insufficient to meet the increasing demand. CSA technologies and innovations can improve rice yield and build resilience while reducing Greenhouse gases emissions.
- Proven CSA technologies and innovations have been successfully promoted by AICCRA in Mali. Scaling actions are therefore needed for disseminating these technologies to benefit other West African countries, especially FSRP countries.
- As part of the synergies between AICCRA and the FSRP, a regional event was organized to facilitate the scaling of climate-smart technologies in rice value chains in West Africa. The workshop introduced 23 (44% women) FSRP stakeholders from seven countries to innovative climate-smart technologies for rice value chains and identified actionable steps to enhance the adoption and use of these technologies in FSRP countries.
- Actions suggested by stakeholders included selection of sites and/or beneficiaries of these actions, capacity building, experience sharing, setting-up and strengthening of a technical committee, and monitoring the outcomes of the program.

1. Introduction

From an underutilized cereal, rice (*Oryza sativa* L.) has attracted more interest and has now become a staple food in many Africans. A rapid increase in rice consumption has been observed in Africa mainly due to changes in diet, yet rice production is well below the demand (Fiamohe et al., 2018). Furthermore, rice production is a key human-induced source of GHG. Globally, rice cultivation is estimated to be responsible for about 19% of total agricultural GHG emissions (Zhang et al., 2022; Qian et al., 2023). In Africa, rice cultivation produces 3.7% of agricultural emissions (Tongwane and Moeletsi 2018) with tropical West Africa being the highest contributor (Carlson et al., 2016). This calls for urgent actions to promote climate-smart agriculture technologies and innovations in rice production systems in West Africa.

In Mali, AICCRA (Accelerating the Impact of CGIAR Climate Research for Africa) team has promoted a series of technologies and innovations in rice value chains. As part of AICCRA Additional Financing, where the focus is on the use of CIS/CSA technologies and innovation, AICCRA West Africa cluster in collaboration with Mali cluster is facilitating the scaling and use of CSA technologies and innovations along rice value chain to benefit other West Africa countries. The West Africa Food System Resilience Program (FSRP), World Bank-funded program, with ambition to strengthen food security and build climate resilience

in West Africa has expressed its interest for applying proven CSA technologies and innovations to increase rice yield and resilience. This calls for synergy action between the two programs for creating an enabling environment to facilitate dissemination of the best-bet CSA practices (Zougmore et al., 2023). A Regional Workshop on climate-smart technologies in rice value chains was convened by CORAF, Alliance Bioversity and CIAT and AfricaRice to introduce stakeholders involved in the FSRP program to innovative climate-smart technologies for rice value chains developed or promoted as part of AICCRA. The workshop also focused on identifying actionable steps to enhance the adoption and use of these technologies in FSRP countries. This infonote presents the outcomes of the workshop and highlights key actions for accelerating the use of proven CSA technologies and innovations to improve rice yield in FSRP countries.

2. Methodological notes

The methodology used can be divided into three steps: (i) identification of stakeholders, (ii) selection of proven CSA technologies and innovations and (iii) strategic discussions (figure 1).

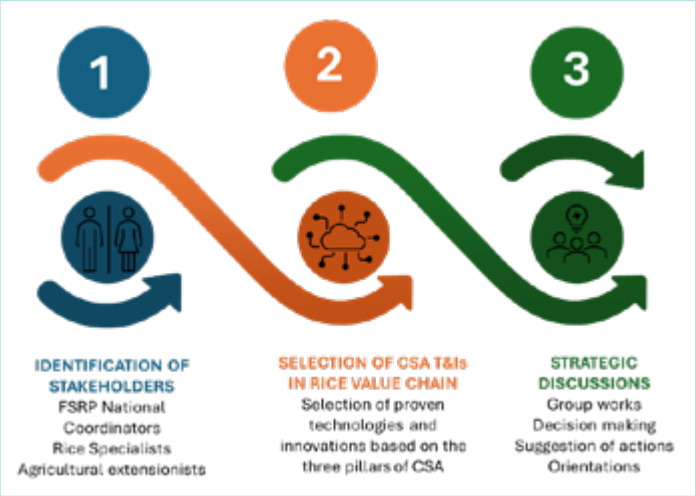

Figure 1: Methodological framework

Identification and selection of the rice stakeholders

Due to the nature of the meeting, three categories of stakeholders were invited: (i) the FSRP coordinators at national and (ii) rice specialists (rice breeders, researchers, rice masters, technicians) and (iii) agricultural extensionists. Delegation from each FSRP country was composed of the coordinator followed by at least one participant from each category.

Identification and selection of proven technologies and innovations along rice value chains

AICCRA Mali team, led by AfricaRice, has developed and promoted CSA technologies and innovations in rice production systems (Dossou-Yovo et al., 2024). Six best-bet CSA technologies and innovations have been selected.

Strategic discussions for selecting CSA technologies and innovations and identification of actions to accelerate their use

Each country delegation was organized in a group to enable country-specific discussions and selections after presentations of the different technologies and innovations. The group work focused on identifying key actions to be implemented to facilitate the effective use of these technologies. The results of this group's work were presented in plenary session followed by general discussions.

3. Results

3.1. Categorization of the stakeholders

Twenty-three participants (including 10 women) from seven FSRP countries (Burkina Faso, Ghana, Mali, Niger, Senegal, Sierra Leone and Togo) attended the event (Figure 2).

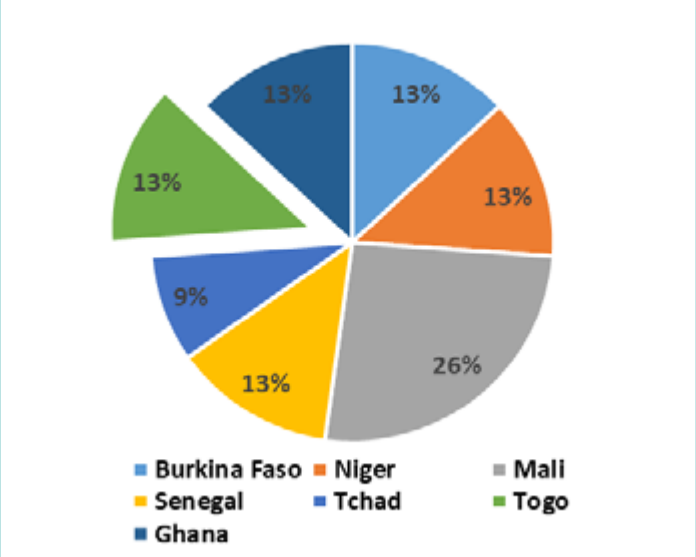

Figure 2a: Percentage of stakeholders from FSRP countries participant to the meeting

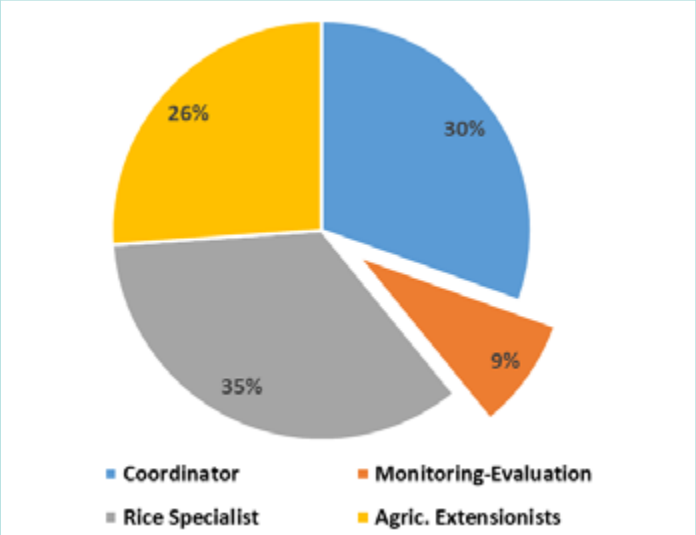

Figure 2b: Status of the various stakeholders who participated in the meeting

3.2. CSA technologies and innovations in rice production systems promoted by AICCRA

Six CSA technologies and innovations were selected and introduced to the participants during the workshop. These include:

- **RiceAdvice** is a free Android decision support tool, that provides specific crop management guidelines for rice production.
- **Smart-Valleys** is a practice of water management with low-cost laying-out of the rice plots. It is a participatory, and easy to apply practice for inland valley development combining farmers and technicians' knowledge with the use of local equipment.
- **Alternate wetting and drying** is a water management practice that aims to reduce water use while maintaining or increasing rice yield in irrigated systems.
- **Integrated rice-fish production** consists of combining rice cultivation with fish farming in the same field or in adjacent fields
- **Solar-powered irrigation system** is an innovative approach to agricultural production that uses solar energy to power water pumps for irrigation. The Pay as you go model gives rice farmers the possibility to pay the solar equipment and installation carried out by a private supplier in instalments.
- **Climate resilient rice varieties** consists of (a) drought tolerant varieties; (b) cold tolerant varieties, and (c) submergence tolerant varieties

3.3. Discussion on scaling mechanisms of selected CSA technologies and innovations

3.3.1. RiceAdvice

One of the successful mechanisms for scaling this technology in Mali with SYNGETA and Nigeria was the partnership with the private sector: recruiting young service providers to disseminate the application (Training of 120 young service providers (30% women) supporting 90,000 farmers). In general, the main achievement using the app during this scaling campaign was the increase in rice yields and income generated from the activity, while reducing inputs like NPK fertilizers. As a lesson learned, there is a need to strengthen the capacity of extension officers to facilitate the dissemination of the application. The business model used for the dissemination of the application in Nigeria, considering the pedoclimatic data and new rice varieties were suggested by the stakeholders as flagship actions for the next scaling-up campaigns of the app. There are also strong results that can serve as models for disseminating the app from Mali and Senegal to other West African countries. One of the key recommendations to facilitate the use of the app is to strengthen the technical team working on the application at AfricaRice with resource persons from the National Agricultural Research Systems (NARS) of the different countries to make the process of updating information needed for operating the application.

3.3.2. Smart-Valleys

Discussions around scaling of this technology were related to plausible constraints that could hinder the effective use of the practice. These include lack of expertise, use of machinery for the implementation, management of land developed by producers, etc. Thus, as a solution, it was suggested the full involvement of landowners in the implementation of the approach in a co-construction process. The implementation of this practice requires a larger labor force, it was therefore advised to define mechanisms for stimulating motivation of rice producers during the process. To be economically viable, the approach will need to be implemented on a minimum of 2 ha.

3.3.3. Alternate Wetting and Drying

Mechanisms for scaling this technology can be summarized as field demonstrations organized by AfricaRice and NARS; training of trainers to farmers; capacity building of technicians. Results obtained in Côte d'Ivoire, Mali and Senegal showed that the use of this practice, significantly reduces the amount of water used for irrigation (about 19% water saved) without having any negative impact on rice yield (Arouna and Akpa 2019). It rather increases yield (up to 50% compared to the conventional practice), especially when combined with application of organic matter, and contributed to reducing GHG emissions by 57% (Arouna and Akpa 2019). Based on these positive effects, participants agreed without any other comments to apply the above-mentioned scaling mechanisms in their various countries.

3.3.4. Integrated rice-fish production

Similar scaling mechanisms were used to disseminate this practice to farmers including backstopping in fields demonstration and farmers' field days. Based on Mali's experience, stakeholders at the workshop expressed the will to extend explanations on technical aspects of the technology such as: (i) the model with floating rice, (ii) the density of the fish fly, (iii) the depth of the pond, (iv) the rice varieties suitable for this kind of system, (v) the period of poisoning the pond, (vi) the cost of feeding fish, (vii) water

management techniques used in systems, (viii) types and breeds of fish, and (ix) emission or sequestration potentials of greenhouse gases. As response, advice from AfricaRice team was to use this practice with rice varieties tolerant to waterlogging (permanent presence of water to maintain fish production), the depth of the pond should be 50 cm and the density of the fry 5 per m2. To avoid GHG emissions and nitrogen accumulation that can lead to over-eutrophication of the system, it was advised to renew the water in the ponds. Additional feeding of fish can also be done using rice bran, industrial fry feed, compost to produce maggots, etc. Proposed dissemination mechanisms were those applied by in Mali.

3.3.5. Solar powered irrigation system: the Pay as you go model

Synergy actions between Eco-tech (a private sector) and AICCRA team in Mali for the scaling-up of the pay-as-you-go model can be summarized as (i) organization of networking workshops, information and (ii) contract signing between producers and Eco-Tech. There are also training or capacity building actions for farmers on the use and maintenance of the solar powered irrigation system. The solar powered irrigation system seems to be a more suitable for vegetables production, however it has helped to replace conventional motor pumps used in rice systems by this renewable source of energy. However, some challenges were identified during the implementation in some countries. In Burkina Faso, large-scale adoption of the technology was limited by fluctuations in water flows. In Niger, limited irrigation time, high winds, challenges with system maintenance and repair, theft of solar panels were some of the frequently mentioned challenges.

3.4. Key actions for accelerating the adoption of selected CSA technologies and innovations

From the presentations, group breakout sessions and plenary discussions, participants suggested key actions for enabling and facilitating the use of the technologies. Table 1 presents the technologies and innovations selected by the country delegations as well as these proposed implementation actions.

Table 1: *CSA technologies and innovations selected by the country for dissemination*

Country	TECHNOLOGIES SELECTED BY THE COUNTRY	PROPOSED SCALING ACTIVITIES/ACTIONS
Togo	RiceAdvice	■ Identification of the implementation sites /Lowland valleys ■ Training of farmers leaders, selected farmers and extension agents ■ Run a pilot phase in a selected area as a paid service
	Smart Valley	■ Extend the training to other regions ■ On-site demonstration to serve as practical in targeted areas ■ Organize exchange visits for knowledge sharing ■ Support (in need) farmers and cooperatives to acquire small machineries/equipment as (man tiller) use to facilitate the implementation of the technology
	AWD	■ Extend the training to other regions ■ Organize exchange visits for knowledge sharing ■ Support (in need) farmers and cooperatives to acquire small machineries/equipment as (man tiller) use to facilitate the implementation of the technology
	Solar powered irrigation: the Pay as you go model	■ Identification of beneficiaries ■ Provision of kits by the service provider
	SRP	■ Sensitization of at least 10 rice cooperatives ■ Training of technicians supporting these cooperatives ■ Supporting farmers and monitoring/tracking of the changes made

Country	TECHNOLOGIES SELECTED BY THE COUNTRY	PROPOSED SCALING ACTIVITIES/ACTIONS
Chad	RiceAdvice	■ Identification of intervention areas ■ Conduct a baseline survey ■ Capacitating rice farmers (training of trainers, training of producers, etc.) ■ Implementation of RiceAdvice (implementation of customized recommendations) ■ Monitoring, evaluation and capitalization
	Climate-resilient rice varieties	■ Preliminary discussion and contracting with the relevant research institutes or seed production companies providing the seed ■ Introduction of varieties to national organizations like KAFACI and ARICA ■ Conduct crop varieties adaptability test (in national context) ■ Facilitate national certification Procedure
	Integrated rice-fish system	■ Conduct a baseline survey ■ Capacitating rice farmers (training of trainers, training of producers, etc.) ■ Exchange visits for experience sharing ■ Monitoring, evaluation and capitalization
Niger	RiceAdvice	■ Training of trainers ■ Training of agricultural extension agents and advisory services ■ Supporting farmers or cooperatives with material (affordable smartphone for the App) ■ Dissemination
	Smart Valley	■ Evaluate the status of implementation of the technology at country level ■ Identification of implementation sites ■ Training of stakeholders (executives, NGOs, producers and others) on the implementation of technology ■ Establishment of demonstration fields ■ Organize experiences exchange trips to sites that have already experienced the technology ■ Monitoring and evaluation of the scaling process
	AWD	■ Identification of implementation sites ■ Training of stakeholders (executives, NGOs, producers and others) on the implementation of technology ■ Establishment of demonstration fields ■ Monitoring and evaluation of the scaling process
Senegal	RiceAdvice	■ Capacity building of trainers (agricultural extension agents in the central and southern area) ■ Training of the facilitators in the central and southern area. ■ Exchange visits (sharing of experience) between the counsellors in the irrigated and rain-fed areas. ■ Monitoring and evaluation
	Smart Valley	■ Participatory selection of implementation sites in the central and southern areas with farmers' organizations ■ Information and awareness of beneficiaries on the project. ■ Capacity building of agricultural extension agents (advisors) ■ Establishment of a local planning and management committee ■ Establishment of demonstration sites

Country	TECHNOLOGIES SELECTED BY THE COUNTRY	PROPOSED SCALING ACTIVITIES/ACTIONS
	Smart Valley	■ Monitoring and maintenance of the system
	AWD	■ Selection of sites and facilities needed for the implementation of the technology (e.g: drainage) ■ Rehabilitation of existing sites and facilities ■ Capacity building of agricultural advisors and farmers ■ Establishment of local monitoring committees
	Solar powered irrigation: the Pay as you go model	■ Identification of cooperatives/farmers having adapted sites and network for running the technology ■ Solar system acquisition and installation with private sector ■ Establishment of a monitoring committee
Mali	RiceAdvice	■ Training and acquisition of equipment (smartphone) to facilitators (Technical Services and NGOs) ■ Support to farmers (recruitment, survey, recommendations, monitoring practices) ■ Follow-up project evaluation
	Smart Valley	■ Training of NGOs and technical services on the SMART Valley process ■ Identification of sites ■ Exchange visits ■ Environmental and Social Screening ■ Monitoring -evaluation
	AWD	■ Training of NGOs and technical services on the AWD process ■ Identification of sites ■ Environmental and Social Screening ■ Monitoring -evaluation
	Solar powered irrigation: the Pay as you go model	■ Evaluation and identification of potential sites ■ Acquisition and sharing of solar equipment ■ Follow-up and evaluation
Mali	SRP	■ Training of trainers ■ Trained agents to train farmers ■ Follow-up surveys – evaluation ■ Identification of capacity building actions for producers in sustainable rice production. ■ Capacity building of farmers in sustainable rice production.
	Climate-resilient rice varieties	■ Identification of varieties according to national ecology, biotic and abiotic constraints. ■ Facilitate access to these varieties for producers ■ Training of producers ■ Monitoring and evaluation
Ghana	RiceAdvice	■ Strenghten partnership with AfricaRice ■ Harmonized FSRP operational areas with AfricaRice to scale RiceAdvice ■ Train selected youth (private sector, extension officers, researchers, irrigation scheme managers) on RiceAdvice ■ Identify areas where RiceAdvice services have been rolled out ■ Exchange visit (Both local and Foreign) to get firsthand experience in RiceAdvice usage ■ Scale up the use of RiceAdvice in Ghana.

Country	TECHNOLOGIES SELECTED BY THE COUNTRY	PROPOSED SCALING ACTIVITIES/ACTIONS
Ghana	Smart Valley	■ Feasibility studies and community engagement has begun to ascertain land ownership, safeguard issues, and cost of construction ■ Confirm inland valleys suitable for Smart-Valley approach ■ Construction of Smart-Valley ■ Signing of MOU between farmers and landowners ■ Roll out the Smart-Valley approach ■ Set-up management and operation mechanisms
	AWD	■ Establish demonstrations fields to farmers to more areas ■ Involve Ghana Irrigation Development Authority (GIDA) ■ Train Scheme managers of GIDA, Technicians, Extension Agents, FBOs on AWD ■ Enforce policies at irrigation schemes ■ Pilot holistic GIDA approach at irrigation schemes
	Climate-resilient rice varieties	■ Identify climate-smart varieties (Early morning flowering, salinity, submergence, etc.) ■ Perform adaptive and verification trials ■ Demonstrate potential climate-smart varieties to farmers ■ Seed production and multiplication of seed varieties
Burkina Faso	RiceAdvice	■ Raise awareness among producers; ■ Identification of producers; ■ Mobilization of trainers (AfricaRice, INERA); ■ Training of trainers (supervisory staff); ■ Training of farmer leaders (20 per site) ■ Acquisition of equipment (smartphone) ■ Site selection (Vallée du Kou, Banzon, etc.) ■ Technology deployment in the field ■ Follow up
	AWD	■ Identification of implementation sites ■ Capacity building on practice ■ Acquisition of equipment
	Climate-resilient rice varieties	■ Acquisition of the Prebase varieties ■ Basic seed propagation ■ Propagation of certified seeds ■ Demonstration tests ■ Sharing of seeds to producers

4. Conclusion and recommendations

Six CSA technologies and innovations in rice production system and promoted by AICCRA Mali team were presented to FSRP country delegations. All the technologies were of interest to the stakeholders who selected in average three of them to be implemented based on their country context. Suggested scaling actions/activities were mainly related to (i) identification of implementation sites, (ii) identification of the beneficiaries, (iii) acquisition and sharing of small equipment, (iv) capacities building to extensionists and famers and (v) monitoring and evaluation of their actions.

From the plenary discussions, the following recommendations have been made to foster the use of the technologies and innovations:

- Organized regional and practical training on technologies identified by countries with a focus on AWD and Smart valley
- Land security: Identify ways and means to raise awareness among the population at the grassroots level.

- Clearly define the capacity building and equipment needs to be transmitted to CORAF for facilitation
- Systematic gender mainstreaming in the implementation of the various targeted actions and activities in FSRP countries
- Consideration of the impact of birds' attacks on rice production and design or suggest technology or innovation of this recurrent problem
- Considering access markets and packaging challenges in the implementation of the actions
- Involvement of extensionists for effective dissemination of technologies at the grass-roots level
- Consider the development of a country-level technology scaling full action plan.

5. References

- Carlson K.M., J.S. Gerber, N.D. Mueller, M. Herrero, G.K. MacDonald, K.A. Brauman, P. Havlik, C.S. O'Connell, A. Johnson, S. Saatchi, P.C. West 2016. Greenhouse gas emissions intensity of global croplands Nat. Clim. Chang. 10.1038/NCLIMATE3158
- Fiamohe, R., Demont, M., Saito, K., Roy-Macauley, H. & Tollens, E. 2018. How can West African rice compete in urban markets? A demand perspective for policymakers. *EuroChoices* **17**, 51–57.
- Qian, H., Zhu, X., Huang, S. *et al.* 2023. Greenhouse gas emissions and mitigation in rice agriculture. *Nat Rev Earth Environ* **4**, 716–732. https://doi.org/10.1038/s43017-023-00482-1
- Tongwane, M.I. and Moeletsi, M.E., 2018. A review of greenhouse gas emissions from the agriculture sector in Africa. *Agricultural Systems*, *166*, pp.124-134.
- Zhang Z., B. Poulter, S. Knox, A. Stavert, G. McNicol, E. Fluet-Chouinard, A. Feinberg, Y. Zhao, P. Bousquet, J.G. Canadell 2022. Anthropogenic emission is the main contributor to the rise of atmospheric methane during 1993–2017. Natl. Sci. Rev., 5 (2022), Article nwab200
- Zougmoré RB, Ali A, Lamien N, Segnon AC, Freeman KK. 2023. Synergies between the Food System Resilience Program (FSRP) and the Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA) in West Africa: implementation domains for cross-fertilization. AICCRA Info Note. Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA).

This info note is an output of the partnership between AICCRA West Africa cluster and CORAF, an association of national agricultural research systems in 23 West and Central Africa countries. As part of the synergies between AICCRA and the FSRP programs, a regional event was organized to facilitate the scaling of climate-smart technologies in rice value chains in West Africa. The workshop introduced FSRP stakeholders from seven countries to innovative climate-smart technologies for rice value chains and identified actionable steps to enhance the adoption and use of these technologies in FSRP countries.

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ABOUT AICCRA

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Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA) is a project that helps deliver a climate-smart African future driven by science and innovation in agriculture. It is led by the Alliance of Bioversity International and CIAT and supported by a grant from the International Development Association (IDA) of the World Bank. Explore our work at aiccra.cgiar.org

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