

Innovative Water Management in Irrigated Rice Fields: Participatory Demonstration Approach to Promoting Alternate Wetting and Drying and Tailwater Harvesting in Ghana

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Field Demonstration Report

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About the CGIAR SI-MFS Initiative

The [Sustainable Intensification of Mixed Farming Systems Initiative](#) aims to provide equitable, transformative pathways for improved livelihoods of actors in mixed farming systems through sustainable intensification within target agroecology and socio-economic settings. Through action research and development partnerships, the Initiative will improve smallholder farmers' resilience to weather-induced shocks, provide a more stable income and significant welfare benefits, and enhance social justice and inclusion for 13 million people by 2030.

Activities will be implemented in six focus countries globally, representing diverse mixed farming systems: Ghana (cereal–root crop mixed), Ethiopia (highland mixed), Malawi (maize mixed), Bangladesh (rice mixed), Nepal (highland mixed), and the Lao People's Democratic Republic (upland intensive mixed/ highland extensive mixed).

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Cover Photo: Rice Field in Botanga Scheme, Ghana.

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Executive Summary

This report highlights the implementation of Alternate Wetting and Drying (AWD) and tailwater harvesting technologies in Ghana, targeting sustainable rice production in the Northern and Ashanti regions. AWD, a water-saving irrigation method, and tailwater recovery systems were demonstrated to optimize water use, reduce environmental impacts, and improve farm productivity. The initiative included demonstration plots, capacity-building workshops for Agricultural Extension Agents (AEAs), and farmer engagement activities to promote adoption.

AWD has been validated to save up to 30% of irrigation water without compromising rice yields, making it a viable strategy to conserve water resources, mitigate greenhouse gas emissions, and lower production costs. Tailwater harvesting complemented these efforts by facilitating water reuse, enabling year-round agricultural productivity and the cultivation of high-value crops like okra. This diversified farm output improved dietary diversity and household incomes while enhancing the resilience of rice-based farming systems.

To ensure broad adoption, a participatory approach was central to the demonstrations. Farmer Field Days (FFD) were organized as key training and knowledge-sharing events, showcasing the application and benefits of AWD and tailwater recovery systems. These events, held on December 4, 2024, in Botanga (Northern Region) and December 6, 2024, in Potrikrom (Ashanti Region), engaged over 100 stakeholders. Participants included farmers, researchers, extension officers, agri-input suppliers, irrigation managers, and policymakers, emphasizing the collaborative efforts required to advance sustainable rice production.

Farmers who attended the FFD events gained practical knowledge on implementing AWD and tailwater harvesting to mitigate water stress during critical crop growth stages and improve yields. The events sparked significant interest, with many farmers expressing readiness to adopt AWD and complementary practices, such as tied ridging, to address challenges like erratic rainfall and water scarcity. Additionally, the events facilitated partnerships between farmers, extension agents, and researchers, fostering a collaborative environment essential for scaling sustainable practices across more rice-growing communities.

Key recommendations from the report include:

1. **Continuous Capacity Building:** Ensure ongoing training for farmers and stakeholders to enhance the adoption and sustainability of AWD and tailwater recovery systems.
2. **Improved Access to Tools and Inputs:** Facilitate affordable access to water-monitoring devices and other essential equipment to support AWD implementation.
3. **Strengthened Partnerships:** Foster collaboration between research institutions, extension services, and farmer groups to ensure effective knowledge transfer and sustained support.

This initiative underscores the potential of integrated water management practices for sustainable agricultural intensification. Scaling AWD and tailwater harvesting across Ghana's diverse ecological zones can address critical challenges such as water scarcity, food insecurity, and climate resilience. These technologies align with Ghana's commitments to the Sustainable Development Goals, including climate action, zero hunger, and responsible resource consumption. By providing validated implementation protocols and fostering collaboration among stakeholders, this project offers a replicable model for transformative change in rice farming, improving livelihoods and ensuring environmental sustainability at scale.

Introduction

Rice is a critical staple crop and a source of livelihood for millions in Ghana, making its sustainable production a key priority for agricultural policy and rural development. With growing urbanization and shifts in dietary preferences, rice consumption has seen a sharp increase, reaching over 1 million metric tons annually, with projections indicating further growth (Amfo et al, 2023; FAO, IFAD, UNICEF, WFP & WHO. 2020). However, local production lags behind consumption, meeting less than 60% of domestic demand, leading to substantial rice imports that strain Ghana's foreign exchange reserves. Enhancing domestic rice production sustainably is an economic necessity and essential for national food security. The Sustainable Intensification of Mixed Farming Systems Initiative (SI-MFS) seeks to address this challenge by validating and promoting innovative, resource-efficient practices for rice production. This report focuses on two key technologies demonstrated and implemented under this initiative: Alternate Wetting and Drying (AWD) and tailwater recovery systems. Together, these practices aim to enhance water management, mitigate environmental impacts, and improve the resilience of rice farming systems in the Northern and Ashanti regions of Ghana.

Rice contributes significantly to the national diet, providing an affordable source of calories for households across all income levels. It is also a vital cash crop, particularly in regions where smallholder farmers depend on it for income. In Ghana, rice cultivation is largely dominated by smallholder farmers who operate on less than two hectares of land and rely heavily on rainfall for irrigation. This dependency exposes rice production to the risks associated with erratic weather patterns, prolonged droughts, and increasingly unpredictable rainfall caused by climate change (Hallegatte et al, 2016). Rice cultivation in Ghana also grapples with inefficient management and wastage of tailwater—water that runs off fields after irrigation. Tailwater often contains valuable nutrients, such as nitrogen and phosphorus, that are critical for crop growth. However, in traditional systems, this runoff is typically lost, either infiltrating into surrounding areas or flowing into drainage systems, where it contributes to waterlogging and nutrient imbalances downstream. The wastage of tailwater not only represents a loss of essential agricultural inputs but also exacerbates the scarcity of water resources, particularly during periods of drought or erratic rainfall. Additionally, the unregulated discharge of tailwater can contribute to environmental degradation by introducing excess nutrients into nearby water bodies, potentially causing eutrophication and harming aquatic ecosystems.

The Northern region of Ghana, characterized by semi-arid conditions, has long faced challenges in water availability, leading to low yields and limited resilience to climate variability. Similarly, the Ashanti region, though wetter, experiences competition for water resources due to population growth, industrial expansion, and deforestation. In both regions, enhancing water efficiency in rice farming is essential for maintaining productivity without exacerbating environmental degradation or resource depletion.

Alternate Wetting and Drying (AWD) offers a transformative approach to rice irrigation. Alternating periods of flooding and drying rather than maintaining continuous submergence,

AWD can reduce water usage by up to 30% without compromising yields (Amankwaa-Yeboah et al, 2023a). The reduction in water usage also curtails methane emissions—a potent greenhouse gas generated under continuously flooded conditions. AWD thus aligns with both local sustainability goals and international climate action commitments. Tailwater recovery systems complement AWD by enabling the capture and reuse of irrigation runoff. These systems enhance overall water use efficiency by reducing wastage and ensuring that excess water is redirected for agricultural or domestic use. For smallholder farmers, tailwater recovery systems represent a cost-effective way to optimize limited water resources, improve soil fertility through nutrient recycling, and enhance overall farm productivity. This approach not only maximizes the efficiency of water and nutrient use but also supports sustainable intensification practices by reducing dependence on external fertilizers and mitigating environmental impacts in Ghana.

Beyond water management, the technologies demonstrated under this initiative address broader systemic challenges. For instance, by reducing the reliance on continuous flooding, AWD helps to conserve water for other agricultural activities and minimizes the competition between different sectors for scarce water resources. Tailwater recovery systems further contribute to integrated water resource management by ensuring that runoff water is available for livestock, domestic use, or supplementary irrigation. The demonstration of AWD and tailwater recovery systems under the SI-MFS initiative marks a critical step toward sustainable intensification in Ghana’s rice sector. Improving resource efficiency using these technologies address the twin goals of enhancing productivity and mitigating environmental impacts.

Implementing AWD and tailwater recovery systems extends beyond technical advancements; it necessitates active engagement and collaboration with farmers, local authorities, and agricultural extension agents. The SI-MFS initiative emphasizes capacity building and field demonstrations as essential components to empower farmers with the skills and knowledge required to adopt these sustainable practices. Stakeholder participation and robust partnerships ensure that these innovations are effectively integrated into local farming systems. With demonstrated success in the Northern and Ashanti regions (Amankwaa-Yeboah et al., 2023a), expanding these practices to other rice-producing areas holds significant potential for advancing Ghana’s food security and sustainability goals.

The Farmer Field Days (FFDs), organized as part of activities under the Sustainable Intensification of Mixed Farming Systems (SI-MFS) initiative through the International Water Management Institute (IWMI) and CSIR-Crops Research Institute (CRI), was aimed at promoting innovative, sustainable rice farming practices tailored to the challenges faced by smallholder farmers in Ghana. This initiative is part of broader global efforts to address climate change impacts, erratic rainfall patterns, and resource constraints, while enhancing agricultural productivity and resilience.

The events showcased two key innovations central to sustainable rice production: Alternate Wetting and Drying (AWD) and tailwater recovery systems, both of which are critical climate change adaptation measures. AWD, imposed as treatment across different rice varieties in this demonstration, is a water-saving irrigation technique that alternates between periods of

flooding and drying, significantly reducing water use while maintaining or enhancing rice yields. In the context of climate change, where erratic rainfall and prolonged dry spells are becoming increasingly common, AWD offers a practical solution to optimize water use, reduce reliance on consistent water supplies, and ensure stable production. Alternate Wetting and Drying (AWD) significantly reduces methane emissions, a potent greenhouse gas, by disrupting the continuous anaerobic conditions typically found in flooded rice fields (The American Academy of Microbiology, 2023). The intermittent drying periods in AWD decrease microbial activity responsible for methane production, thereby mitigating its release into the atmosphere (Susanti et al, 2024). This makes AWD not only a climate adaptation strategy but also a significant contributor to mitigating agriculture's role in climate change.

The integration of tailwater recovery systems complements AWD by addressing the challenge of water scarcity. As climate variability intensifies, efficient water reuse systems are essential to maximize the utility of limited water resources. Tailwater recovery systems capture runoff from rice fields and repurpose it for cultivating high-value crops such as okra, which thrives with supplemental irrigation. This approach not only promotes crop diversification but also improves resource efficiency and boosts farm incomes, providing an economic safety net for farmers during periods of climate-induced stress. AWD and tailwater recovery systems collectively offer comprehensive and scalable solutions to the interconnected challenges of water management and climate resilience. These practices reduce water usage, stabilize crop yields, and diversify farmers' income streams, equipping smallholder farmers to adapt to increasingly erratic climatic conditions while advancing sustainable agricultural intensification in Ghana.

The project demonstration activities sought to achieve the following objectives, among other extended goals:

- i. Demonstrate and promote Alternate Wetting and Drying (AWD) to optimize water, nutrient, and labour use, aiming to keep or improve rice yields while using less water.
- ii. Assess the quality of water harvested from rice farms and its suitability for various agricultural uses, such as watering livestock and supporting other crop production, to promote better resource management.
- iii. Evaluate effects of harvested tailwater water to grow high-value crops like tomatoes, peppers, and okra alongside rice, aiming to make better use of water, boost farm incomes, and ensure year-round agricultural production for better nutrition and food security.

Methodology

Site selection

Demonstration plots were co-established with farmers in Ghana's Northern and Ashanti regions to demonstrate the effectiveness of Alternate Wetting and Drying (AWD) and tailwater recovery technologies and promote adoption. These locations were strategically selected due to their contrasting agroecological conditions, offering a robust platform to evaluate the technologies' adaptability, resilience, and scalability under varying climatic and socio-economic scenarios.

Northern Region: Known for its semi-arid conditions, the Northern region faces critical water scarcity and variability challenges. Agriculture in this region heavily depends on erratic and limited rainfall, making it particularly vulnerable to the impacts of climate change. Implementing AWD and tailwater recovery systems in this region aimed to address these vulnerabilities by introducing water-saving irrigation techniques that stabilize and potentially enhance rice yields under challenging climatic conditions. This region's selection highlights the urgency of adopting efficient water management strategies to ensure agricultural sustainability in water-stressed environments.

Ashanti Region: In contrast, the Ashanti region experiences a relatively wetter climate but grapples with increasing water resource competition driven by population growth, extensive water pollution and scarcity from illegal mining activities and deforestation. This context provided an opportunity to evaluate how AWD and tailwater recovery systems could optimize water use efficiency while maintaining high rice productivity. The region's agricultural diversity and dominance of smallholder farming systems offered a realistic framework to test the scalability and acceptability of these technologies. Addressing the water resource challenges in the Ashanti region, is a critical component of the project, emphasizing the critical importance of integrated water management practices in areas where agriculture competes with industrial, domestic, and environmental demands for water.

In both regions, the selection of demonstration plots took into account factors such as soil type, historical water usage patterns, and community involvement. Engaging local farmers and stakeholders from the onset ensured that the interventions were contextually appropriate and supported by those directly benefiting from the innovations. This participatory approach also facilitated smoother implementation and greater acceptance of the new practices, laying a foundation for successful technology transfer and long-term sustainability.

Farmer Field Day Activities

The Farmer Field Day (FFD) events took place on the 4th of December 2024 in Botanga, located in the Kumbungu District of the Northern Region, and on the 6th of December 2024 in Potrikrom, situated in the Ahafo Ano Southwest District. These two events collectively engaged over 100 stakeholders from diverse sectors, including farmers, researchers,

agricultural extension officers, agri-input suppliers, irrigation scheme managers, and policymakers from the District Assemblies.

Knowledge Sharing

Interactive sessions facilitated by research staff from the CSIR-Crops Research Institute, provided participants with insights into the principles and benefits of AWD and tailwater recovery systems. Farmers learned how these innovations optimize water use, enhance yields, and contribute to sustainable rice farming amidst climate variability. Discussions also focused on the role of these practices in addressing water scarcity and reducing greenhouse gas emissions, key challenges for the beneficiary regions.

Stakeholder Discussions

Discussions involving farmers, extension agents, researchers, and other stakeholders addressed the opportunities and challenges associated with adopting AWD and tailwater recovery systems. Discussions covered critical topics, such as overcoming barriers like limited access to inputs and knowledge gaps, as well as pathways for scaling these practices across rice-growing regions. Participants explored actionable strategies to integrate these innovations into local farming systems, laying the groundwork for sustainable agricultural intensification and strengthened partnerships among key stakeholders.

Participatory demonstration and field layout

The methodology encompasses participatory innovation demonstration by co-development of plots where AWD practices were compared against traditional continuous flooding methods. Detailed demonstration protocol is as described by Amankwaa-Yeboah et al. (2023b).

Farmers and stakeholders witnessed the implementation of Alternate Wetting and Drying (AWD) and tailwater recovery systems tailored for rice cultivation under real field conditions. The demonstrations featured AWD applied to three high-performing rice varieties, CRI AgraRice, Gbewaa Red, and Jasmine 85, evaluated alongside traditional continuous flooding practices. This comparative approach enabled participants to observe the benefits of AWD in reducing water consumption while maintaining yields. The inclusion of multiple improved rice varieties provided insights into varietal performance under AWD conditions, emphasizing the adaptability and scalability of these innovations in optimizing water use and enhancing productivity within rice-based farming systems.

Treatment Layouts

Mother Plots: These larger experimental fields, each approximately 1 acre in size, served as showcases for three improved rice varieties: Jasmine 85, CRI-Agra, and a local check variety. The Mother Plots were designed to compare the performance of these varieties under AWD conditions versus traditional continuous flooding practices. To ensure a fair comparison, all

other agronomic practices such as fertilizer application, pest control, and weeding were kept consistent across the demonstration plots, with the only variable being the water management method. Key features of the Mother Plots included testing the varieties Jasmine 85, CRI-Agra, and a local check variety, using Alternate Wetting and Drying (AWD) vs. continuous flooding for water management practices, and maintaining uniform application of agronomic practices to isolate the effect of water management on rice yield and growth parameters.

Baby Plots: Smaller, farmer-managed plots, each approximately 1200 m², focused on simplified applications of AWD using a single rice variety of the farmer's choice. The Baby Plots (Figure 1) aimed to test the feasibility and adoptability of these technologies by smallholder farmers, while also serving as platforms for farmer-to-farmer knowledge sharing and capacity building. Local farmers were trained and supported to manage the Baby Plots, ensuring the technologies were adapted to their specific needs and contexts.



Figure 1: Pictures from demonstration sites

Each plot included a range of treatments varying by water management practices (AWD vs. continuous flooding) and crop variety. Detailed layouts of treatment configurations, plot sizes, and the performance parameters monitored are provided in Table 1. The treatment layouts were designed to capture a comprehensive set of data on how different rice varieties respond to AWD and continuous flooding under local conditions. Water table cylinders (perforated PVC pipes), described by Amankwaa-Yeboah et al. (2023b), were installed in the field to monitor groundwater levels for irrigation scheduling in the AWD plots.

Table 1 Treatment and plot area for mother and baby plots across locations

No	Region	Community	Demonstration Type	Treatment	Total Plot Area (m ²)
1	Northern	Botanga	Mother	AWD/CRI AGRA; CF/CRI AGRA; AWD/JASMINE 85; CF/JASMINE 85; AWD/GBEWAA RED; CF/GBEWAA RED	2500

			Baby A	AWD/JASMINE 85; CF/JASMINE 85	1200
			Baby B	AWD/CRI AGRA 85; CF/CRI AGRA	1200
			Baby C	AWD/GBEWAA RED; CF/GBEWAA RED	1200
2	Ashanti	Potrikrom	Mother	AWD/CRI AGRA; CF/CRI AGRA; AWD/JASMINE 85; CF/JASMINE 85; AWD/GBEWAA RED; CF/GBEWAA RED	4000
			Baby D	AWD/CRI AGRA; CF/CRI AGRA	1200
			Baby E	AWD/JASMINE 85; CF/JASMINE 85	1200
			Baby F	AWD/GBEWAA RED; CF/GBEWAA RED	1200

*AWD = Alternate wetting and drying

**CF = Continuous Flooding

Sampling design and water analysis for the tailwater harvesting

This methodology assesses the quality of water harvested from rice farms and its suitability for various agricultural uses, such as watering livestock and supporting other crop production.

Water Sampling

Water samples were collected from all demonstration locations across the project regions. The samples were taken from the distribution canals, and harvested water storage ponds (Figure 2). The collected water samples underwent comprehensive analysis to determine their suitability for agricultural uses. The analysis encompassed several key quality parameters, which were measured using established scientific methods. The pH levels of the water samples were measured to determine their acidity or alkalinity. This was done using a calibrated pH meter. Temperature was recorded using digital thermometers to monitor its impact on other water quality parameters and biological processes.

The turbidity of the water, indicating the presence of suspended solids, was assessed using a turbidity meter. Total Dissolved Solids (TDS) were measured to determine the combined content of all inorganic and organic substances dissolved in the water. This parameter was quantified using a TDS meter, which helps gauge the water's quality and suitability for irrigation. Electrical Conductivity (EC) was measured using an EC meter to assess the water's ability to conduct electric current, which correlates with the concentration of dissolved salts. The concentrations of essential nutrients, Nitrate, Phosphate, soluble Potassium, sodium, Calcium, and Magnesium were analysed using spectrophotometric methods and chemical assays in the laboratory of the Crop Research Institute, Kumasi, Ghana.



Figure 2: Sampling tailwater for physicochemical analysis

Demonstration of tailwater reuse

This study aims to assess the impact of using harvested tailwater to grow high-value crops, such as okra, aiming to optimize farm water use, enhance farm incomes, and support year-round agricultural production for improved nutrition and food security. The demonstration was conducted at the project locations, each hosting three okra fields measuring 20 m × 20 m. Each field was demarcated into two plots with respective plots allocated to different water treatment. One part of the plot was irrigated with water sourced from the main stream dam whilst the other was irrigated using the harvested tailwater. Water distribution was managed using pre-existing canal networks to deliver water through furrow irrigation to the okra fields.



Figure 3 Okra field irrigated using harvested tailwater from irrigated rice

Data Collection

We observed the crop's agronomic development together with the farmers. The increasing plant height and tiller count were observed in the AWD. The farmers directly observed the difference in the agronomic performances of the fields equipped with AWD compared to the continuously flooded fields. Similarly, the okro fields irrigated with tailwater from rice fields were equally monitored by the farmers and extension workers.

Subsequently, the observed agronomic and physiological parameters, such as plant height, tiller count, flowering rate, and grain yield, were recorded throughout the growing season. Additionally, soil moisture content, water use efficiency, and nutrient uptake were monitored to assess the impact of different irrigation practices on rice production.

Field Engagement and Feedback

Farmers actively participated in assessing the demonstrated practices and providing feedback based on their observations and experiences. This participatory approach ensured that the promoted technologies align with the realities of smallholder farming, enhancing their relevance and adoption potential. Stakeholders also shared local success stories, further enriching the knowledge exchange and building farmer confidence in these innovations. Figure 4 contains sessions with farmers, and extension workers interacting with research staff in the AWD rice field and Okro field irrigated with tailwater.

Key Technologies Demonstrated

The AWD technique was demonstrated as a water-saving irrigation practice capable of reducing water consumption by up to 30% while maintaining or enhancing rice yields. This innovative method alternates between flooding and drying periods, addressing water scarcity and minimizing methane emissions, which are significant contributors to climate change. During the demonstration, three improved rice varieties, CRI AGRA Rice, Gbewaa Red, and Jasmine 85, were subjected to AWD treatment alongside the traditional farmer practice of continuous flooding. This comparison showcased the adaptability of AWD to different rice genotypes and its potential to optimize water use across diverse farming systems. Participants observed how AWD reduced water wastage without compromising productivity, highlighting its dual benefits of resource efficiency and environmental sustainability.

Advanced versions of water table AWD cylinders for monitoring and scheduling irrigation were introduced to the participants. These upgraded devices are equipped with GSM technology, enabling them to send alerts to farmers' mobile phones when their rice fields require water, simplifying the irrigation scheduling process. This advancement underscores the integration of digital solutions into traditional farming practices, enhancing efficiency and decision-making. Networking opportunities during the event also facilitated connections between farmers, researchers, extension officers and other stakeholders, laying the groundwork for ongoing collaboration and resource sharing.

Tailwater recovery systems were presented as a complementary innovation, emphasizing the importance of capturing and reusing irrigation runoff. This practice demonstrated how runoff water could be stored and reused to irrigate high-value crops such as okra, diversifying farm incomes and enhancing overall water-use efficiency. Utilizing water that would otherwise go to waste, tailwater recovery reduces the strain on water resources, particularly in regions with frequent erratic rainfall and dry spells. Participants also learned how integrating these systems into existing farming practices could support a more holistic and sustainable approach to agricultural intensification.



Figure 4: A section of stakeholders interacting with research staff

Outcomes from the Farmer Field Day Activities

- i. **Improved Awareness:** Farmers participating in the field day gained invaluable firsthand experience with the practical application of Alternate Wetting and Drying (AWD) and tailwater recovery systems. These technologies were demonstrated in real-world settings, allowing farmers to observe their effectiveness in reducing water stress during critical growth phases. This hands-on learning experience significantly increased farmers' understanding of how these methods can be implemented to improve water management and crop resilience.
- ii. **Increased Interest and willingness to adopt showcased technologies:** The field day generated considerable interest among farmers in adopting AWD and tailwater recovery practices. Many farmers recognized the potential of these innovative techniques to stabilize yields during periods of erratic rainfall. The demonstrations highlighted the benefits of these practices in enhancing water use efficiency and reducing the vulnerability of crops to water stress. As a result, numerous farmers expressed their readiness to incorporate these methods into their own farming systems, aiming to achieve more consistent and reliable crop production.
- iii. **Strengthened Collaboration:** The field day served as a vital platform for fostering collaboration among farmers, extension agents, and researchers. Through interactive sessions and open dialogues, participants shared their experiences, insights, and challenges related to water management practices. This exchange of knowledge and

ideas paved the way for stronger partnerships and collective efforts to scale these practices across more rice-growing communities. The event emphasized the importance of continuous support and communication among stakeholders to ensure the successful adoption and adaptation of these sustainable farming techniques.

Feedback, Insights, and Recommendations

The feedback, insights, and recommendations gathered during the field day have further strengthened the advantages of inclusivity and contribution of users of the technologies. It has also refined the approach to the scaling under the Sustainable Intensification of Mixed Farming Systems (SI-MFS). These discussions provided valuable perspectives from farmers, researchers, and extension agents, helping identify key barriers to adoption and areas for improvement. A summary is presented here.

- i. Participants emphasized the necessity for ongoing training programs to deepen their understanding and facilitate the adoption of demonstrated practices. Continuous education efforts are essential to keep farmers updated on the latest techniques and technologies, ensuring that they can implement these practices effectively and sustainably.
- ii. Farmers highlighted the need for improved access to essential tools and inputs, such as water monitoring devices for Alternate Wetting and Drying (AWD) and equipment for tied ridge planting. Providing these resources will enable farmers to adopt new practices more efficiently and effectively, leading to better water management and crop resilience. Ensuring affordability and availability of these tools is crucial for widespread adoption.
- iii. Strengthening partnerships between research institutions, extension services, and farmer groups was emphasized as a critical factor for sustained support and knowledge transfer. Collaborative efforts will facilitate the sharing of research findings, practical insights, and technological advancements, fostering a supportive network that helps farmers continually improve their practices.
- iv. Participants shared practical challenges they face in the adoption of new technologies, such as the initial cost of equipment and the need for adaptation to local conditions. Addressing these challenges through tailored solutions and support mechanisms is essential for successful implementation.
- v. Farmers recommended policy interventions that could support the adoption of innovative practices. This includes subsidies for critical inputs, financial incentives for investment in new technologies, and policies that promote sustainable farming practices. Government and institutional support can play a pivotal role in enabling farmers to transition to more efficient and resilient agricultural systems.
- vi. The feedback highlighted the importance of community-based approaches in promoting collective learning and implementation. Encouraging community engagement and peer-to-peer learning can enhance the adoption rate of new practices and create a collaborative environment for problem-solving and innovation.

Conclusion

The ongoing implementation of Alternate Wetting and Drying (AWD) and tailwater recovery systems in the Northern and Ashanti regions of Ghana holds significant potential to revolutionize water management in rice cultivation upon full adoption. AWD technology has been proven to reduce water consumption by up to 30% without compromising rice yields, making it an effective strategy for optimizing water use efficiency. This water-saving technique aligns with sustainable intensification principles by enhancing productivity and conserving vital water resources. Complementing AWD, tailwater recovery systems capture and reuse irrigation runoff, improving resource use efficiency and supporting diversified agricultural practices. This diversification enhances farm income streams and dietary diversity and strengthens food security in local communities. Integrating these practices significantly contributes to environmental sustainability by conserving water, reducing methane emissions from paddy fields, and fostering a circular economy within farming systems.

The Sustainable Intensification of Mixed Farming Systems (SI-MFS) initiative demonstrates the transformative potential of integrated water management practices, such as Alternate Wetting and Drying (AWD) and tailwater recovery systems, for sustainable rice production in Ghana. Through Farmer Field Days, participants gained practical insights into these techniques, witnessing their effectiveness in reducing water stress, improving crop yields, and enhancing resilience to climate variability. These events fostered collaboration among farmers, researchers, and extension agents, emphasizing the importance of partnerships for scaling water management innovations. Supported by organizations like IWMI and CRI, the initiative highlights the role of continuous interactions with the farmers, technical support, and resource provision in achieving agricultural sustainability and aligning with national food security goals.

References

- Amankwaa-Yeboah, P., Zemadim, B., Oke A., Yeboah S., Okyere., Adomako J., Adabah R., Keteku A. K. and Cofie, O.O. (2023a). Farmers led investigation of alternate wetting and drying (AWD) technology for off-season rice production. Ibadan, Nigeria: IITA. <https://cgspace.cgiar.org/items/21c628eb-51dd-490c-919b-19e45160758d>
- Amankwaa-Yeboah, P., Zemadim, B., Oke, A., Stephen, Y., Okyere H., Adomako J., Adabah R. and Cofie, O.O. (2023b). Methodological report on Alternate wetting and drying technology and tailwater recovery in rice production systems in the Northern and Ashanti regions of Ghana. Ibadan, Nigeria: IITA. <https://hdl.handle.net/10568/135419>
- Amfo, B., Abankwah, V., & Bahahudeen Shafiwu, A. (2023). Local rice consumption and attributes considered in urban Ghana: Does internal migration matter? *Cogent Food & Agriculture*, 9(2). <https://doi.org/10.1080/23311932.2023.22810988>
- FAO, IFAD, UNICEF, WFP & WHO. 2020. The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets. Rome, FAO. <https://doi.org/10.4060/ca9692en>

Hallegatte, Stephane, Mook Bangalore, Laura Bonzanigo, Marianne Fay, Tamaro Kane, Ulf Narloch, Julie Rozenberg, David Treguer, and Adrien Vogt-Schilb. 2016. Shock Waves: Managing the Impacts of Climate Change on Poverty. Climate Change and Development Series. Washington, DC: World Bank. doi:10.1596/978-1-4648-0673-5. License: Creative Commons Attribution CC BY 3.0 IGO

Susanti, W. I., Cholidah, S. N., & Agus, F. (2024). Agroecological Nutrient Management Strategy for Attaining Sustainable Rice Self-Sufficiency in Indonesia. *Sustainability*, 16(2), 845. <https://doi.org/10.3390/su16020845>

The American Academy of Microbiology (2023) Role of microbes in mediating methane emissions. Report on an American Academy of Microbiology (Academy) and The American Geophysical Union (AGU), Colloquium held on May 31 & June 1, 2023. <https://doi.org/10.1128/aamcol.nov.2023>