International Water Management Institute

Water Issue Brief - 14

Putting research knowledge into action

Agricultural water management innovations to build resilient food systems in West Africa

The context

Agriculture, the largest user of water globally, is the engine of food security and an important source of employment across West Africa. As competition for water intensifies, food systems must become more sustainable and resilient, meeting the nutritional needs of growing populations without undermining the natural resource base on which they depend. In addition, changing demographics and gender roles require new solutions that are inclusive of women and meet the needs of young farmers, who are leaving rural areas affected by climate variability in search of opportunities outside of agriculture.

Key messages

- Small-scale irrigation development contributes to sustainable agricultural intensification, food security and climate resilience in rural livelihoods.
- Improved water-use efficiency in agriculture can be achieved through simple, cost-effective technologies and water management innovations.
- Exploiting agricultural water management is key to building food system resilience. Dry season agricultural production, in particular, provides additional income, helping to reduce poverty and enhance food security.

Key issues

Population growth in West Africa is outpacing food production (Staatz and Hollinger 2016), leading to food insecurity, rising food import bills and dependency on international markets. Government agri-food policies and programs tend to favor large-scale production and medium- to large-scale irrigation schemes. Little consideration is given to the needs of smallholders, who grow a large proportion of the region's food (ibid.). This is inhibiting the adoption of integrated water management solutions that have the potential to transform agricultural productivity and improve water-use efficiency. Along the agricultural value chain, smallholder access to technologies and equipment is constrained by underdeveloped supply chains, knowledge gaps and limited financing and energy options.

Agricultural water management can raise the productivity of small farmers like Patience Wussah in Ghana (*photo:* Nana Kofi Acquah/IWMI).

Drawing on decades of experience in agricultural water management (AWM), the International Water Management Institute (IWMI) has developed a bundle of innovative technical and digital tools, methodological frameworks and business models that address key questions such as: how can farmers grow more food using less water? How, and by how much, can AWM raise farmers' productivity and incomes? And how can the twin goals of food production and food system resilience be balanced and achieved, in policy and practice?

Together with governments, practitioners, farmers, private sector actors and other strategic partners, we use the answers to these questions to co-design, co-test and scale low-cost AWM solutions that increase productivity and resource use efficiency in both rain-fed and irrigated systems. All solutions are intended to support equality and empowerment of women and youth in AWM.

Mainstreaming good AWM practices

Most farmers in West Africa are smallholders who rely on rain-fed agriculture to satisfy their basic food needs. Rising temperatures and changing weather patterns are increasing the urgency to mainstream good AWM practices and climate-smart agriculture solutions. Farmer-led irrigation, in which farmers drive investments in irrigation technologies, has emerged as a promising AWM practice. IWMI's focus on farmer-led irrigation is a shift from earlier trends in research and investments that prioritized public, communal irrigation schemes. The performance of these larger schemes has often been disappointing, partly because of water governance challenges. When farmers take irrigation into their own hands, however, our research with partners (Balana et al. 2020) shows that farmers are able to increase production, both by supplementing their rain-fed crops with irrigation water and by growing an additional harvest during the dry season. This can have immense benefits, including better nutrition, higher incomes and greater climate resilience.

A young farmer using sprinklers to irrigate his crops in Ghana (*photo*: Nana Kofi Acquah/IWMI).

Improved water access throughout the year could be particularly attractive to young farmers. In the Upper West Region of Ghana, where IWMI is investigating the link between climate change and migration, water stress due to unpredictable rainfall and poor management of water resources is among the factors causing young farmers to move to cities in search of new opportunities outside of agriculture.

IWMI and partners have successfully initiated multi-stakeholder dialogues around these issues (Minh et al. 2020). Bringing together development planners and decision makers in the community – farmers, local leaders, government officials, environmental agencies – we facilitate discussion on how various solutions, such as water storage and irrigation facilities, might affect the region. The dialogues aim to encourage young farmers and migrants to share their experiences with policy makers and together find contextually relevant ways to improve water governance and access. In turn, government officials are better able to support policies and interventions that promote food system resilience, and sustainable and inclusive rural economic growth.

Partnering with the private sector to accelerate progress

Beyond an enabling policy environment, other barriers exist to the widespread adoption of good AWM practices. These include a lack of affordable credit bundled with best-fit irrigation products and services. In a number of countries, private irrigation equipment companies have stepped in to fill this gap. Alongside financing, they offer after-sales, agronomic and market access services to help farmers optimize their return on investment and reduce the payment default risk (Minh and Schmitter 2020).

IWMI is increasingly partnering with these private companies to accelerate the scaling of proven irrigation technologies (Minh and Schmitter In Review). Over the past few years, we have co-tested a number of irrigation technology and service bundles. The results showed that when shallow groundwater or surface water resources are available, solar-powered pumps can offer an affordable and effective irrigation solution. This is particularly the case in rural areas with no access to electricity. Solar-powered pumps were also found to be cheaper than those powered by diesel and more attractive to women (Nigussie et al. 2017), especially when the pump is located close to home.

In the coming years, we will use our expertise to formulate context-specific business models and financing modalities to help our private partners build more sustainable and inclusive irrigation businesses. For instance, one of our partners has pioneered a pay-as-you-go financing model in West Africa that enables farmers to pay for and eventually fully own solar pumps

Farmers attending a solar panel demonstration during a field trip to Bawku, Ghana (*photo:* Thai Thi Minh/IWMI).

through small, regular installments. Many of these farmers are currently men. By applying a gender lens to areas such as credit scoring, we will customize the model to reach more women.

Developing and applying digital innovations

An important step toward taking good AWM practices to scale was the development of a suitability mapping methodology (Schmitter et al. 2018). By locating suitable and promising areas, water solutions can be scaled more effectively and at higher rates of success. IWMI deployed spatial datasets, information from satellites and machine learning to understand the major drivers for successful introduction of solutions such as solar pumps or suitable locations for farmer-led irrigation development.

In mapping suitable locations for solar water pumps, IWMI's methodology took into account not only solar radiation and climatic conditions but also the type and availability of water resources and linkage to markets. Initial results from Ethiopia showed that, on average, 9% of irrigated land and 18% of rain-fed land would be suitable for solar pump irrigation (Otoo et al. 2018). We subsequently generated maps for Mali (IWMI 2019) and Ghana, where they are an invaluable source of national-level data for private solar irrigation companies looking to expand in those markets. However, the methodology can be applied across sub-Saharan Africa to scale up solar-powered irrigation as a climate-smart technology.

Furthermore, we are drawing on our experience in the Middle East and North Africa region to develop an irrigation advisory app together with the private sector. By sending alerts about potential water shortages, heat waves and crop yield predictions via the app, the aim is to help farmers expand small-scale irrigation, and improve water management and irrigation scheduling.

In other African countries, we are demonstrating the use of various irrigation technologies through the Water Enabler Compact of the African Development Bank's flagship program Technologies for African Agricultural Transformation (TAAT-WEC). TAAT-WEC aims to meet water needs in crop production systems by making high-potential irrigation and water management technologies available to farmers on a massive scale. IWMI is implementing the project in seven countries (Nigeria, Burkina Faso, Mali, Ethiopia, Sudan, Tanzania and Malawi), promoting optimal use of scarce water resources to maximize yields of wheat, rice, sorghum, maize and orange-fleshed sweet potatoes.

Leveraging our skills for post-Covid-19 recovery

More recently, the role of water in building resilience to systemic shocks, such as Covid-19, has made management of this valuable resource a renewed priority among policy makers and development planners. This has resulted in increased demand for IWMI's experience and skills. In particular, the role of water management in safeguarding sanitation, health and food production has come into sharp focus.

IWMI is helping to inform national post-Covid-19 recovery plans by advising governments and environmental and health agencies. In Ghana, IWMI and its implementing partners convened a national policy dialogue to kickstart discussions on social transformation and development in a post-Covid-19 era. The dialogue focused on innovations and programs that would ensure sustainable growth and climate adaptation in the wake of the pandemic.

The way forward

IWMI's research has shown that improving AWM has considerable potential to enhance food system resilience and livelihoods. Across West Africa, farmers are taking matters into their own hands by investing in small-scale water storage and irrigation technologies. Governments, development organizations and the private sector can support this trend through additional investment in water infrastructure, enabling policies, and technical and financial advisory services (Minh and Schmitter In Review). In order for such initiatives to yield sustainable outcomes, however, they must incorporate inclusive business models and context-specific governance arrangements. IWMI provides science-based evidence to ensure that such interventions translate into tangible and long-term benefits for farmers and their communities.

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IWMI International Water Management Institute

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The International Water Management Institute (IWMI) is an international, research-for-development organization that works with governments, civil society and the private sector to solve water problems in developing countries and scale up solutions. Through partnership, IWMI combines research on the sustainable use of water and land resources, knowledge services and products with capacity strengthening, dialogue and policy analysis to support implementation of water management solutions for agriculture, ecosystems, climate change and inclusive economic growth. Headquartered in Colombo, Sri Lanka, IWMI is a CGIAR Research Center and leads the CGIAR Research Program on Water, Land and Ecosystems (WLE).

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