Food and Agriculture Organization of the United Nations

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THE STATE OF FOOD AND AGRICULTURE

Overcoming water scarcity with sustainable irrigation

Water scarcity threatens irrigated agriculture and water-related ecosystems

Irrigated agriculture occupies about 20 percent of total cropland but generates more than 40 percent of total production in terms of value. The higher productivity in irrigated areas relative to rainfed agriculture is due to higher and more stable yields, more intensive cropping and the cultivation of high-value crops. Farmers with access to irrigation control water volumes and timing in a way that is impossible in rainfed farming. Irrigation can facilitate adaptation to climate change, save labour and energy, and allow growing higher-value crops. Irrigation is critical for reaching several Sustainable Development Goals (SDGs), not least the Zero Hunger goal.

However, irrigated agriculture is contributing to, and affected by, growing pressure on freshwater resources. Concerns over scarcity and inefficient use of water are reflected in SDG 6 Target 6.4, which calls for increasing water-use efficiency and ensuring sustainable withdrawals of freshwater to address water scarcity. Globally, more than 60 percent of irrigated cropland is under high water stress. In these areas, action is urgently needed to ensure more productive use of water in irrigation by increasing crop yields and/or reducing evapotranspiration. The scope for productivity gains is considerable, especially in Latin America and the Caribbean, Africa, and parts of Asia, where water productivity gaps are largest. Figure 1 shows actual water productivity and productivity gaps, for three selected irrigated crops by region. The three cereals – maize, rice and wheat – represent more than 40 percent of the global daily kilocalorie supply.

Investments in advanced irrigation, as well as access to markets and modern inputs, are needed. However, a key challenge is to preserve sustainability. Indeed, expanding irrigation can affect overall hydrology and water availability downstream, with possible negative effects on inland fisheries. Only a holistic approach can mitigate negative environmental impacts.

KEY MESSAGES

- To reach Zero Hunger in an increasingly water-scarce world, irrigated agriculture must be made more efficient, equitable and sustainable.
- Improved water governance must accompany investments in expanded and improved irrigation to guarantee equitable access to water and environmental sustainability.
- Well-defined water tenure and rights and improved data and information are cornerstones of better water governance.
- Coherent policies must provide appropriate incentives for equitable, efficient and sustainable water use in agriculture and other sectors.

Sustainable irrigation practices exist, but barriers to adoption must be understood and overcome

More productive use of irrigation water will require investment in new irrigation systems and the rehabilitation of existing ones. Worldwide, there are three main irrigation methods: surface or gravity irrigation; sprinkler or spray irrigation; and dripping or micro-irrigation. The most appropriate system will depend on factors such as agro-climatic conditions, sources and prices of energy, labour availability, depth of groundwater and infrastructure costs. In sub-Saharan Africa, many small-scale farmers are developing small-scale irrigation equipment – including buckets, watering cans and treadle pumps – which tend to have lower unit costs and better performance than larger systems managed by government agencies. Precision agriculture – comprising ICT tools, including GPS, satellites, sensors and aerial images, that provide farmers with site-specific information – allows farmers to enhance irrigation efficiency while minimizing impacts on the environment.

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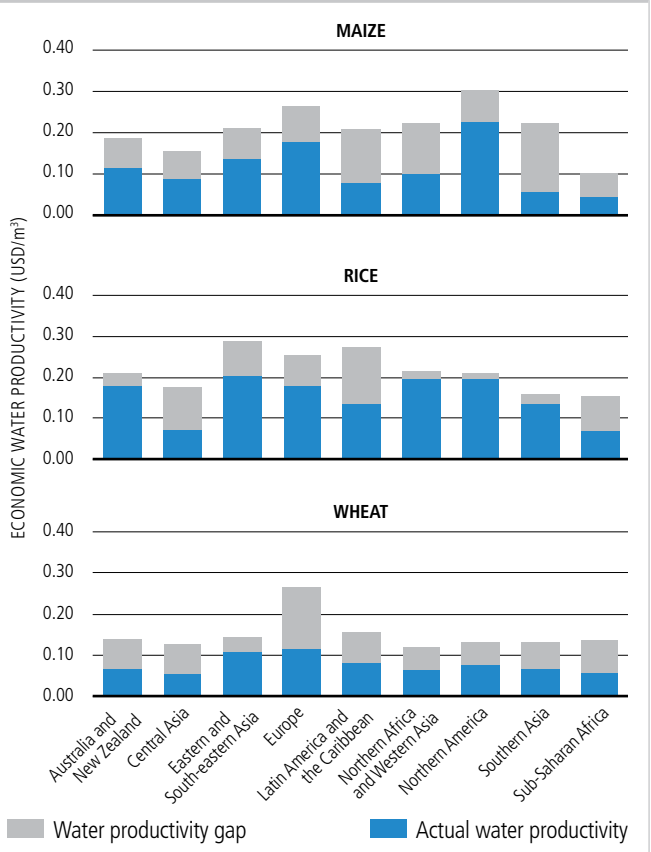
FIGURE 1. Actual economic water productivity and productivity gaps for selected irrigated crops, by region



Source: FAO. 2020. *The State of Food and Agriculture 2020. Overcoming water challenges in agriculture*. Rome.

In water-scarce areas, crop and nutrient selection is also needed, including diversification into higher-value and less-water-demanding crops. An important integrated crop-management option is conservation agriculture, which enhances efficient water and nutrient use. Deficit irrigation – where the crop is exposed to a certain level of water stress – can increase water productivity, although at the risk of lower yield.

However, the adoption of water-saving technologies and management tools will require understanding the constraints faced by farmers, providing information through extension services, and designing appropriate incentive systems, including financial support and favourable credit terms, especially for small-scale farmers. Promoting digital extension tools can help disseminate knowledge of innovative water management tools.

[1] FAO. 2020. *Water accounting and auditing for better water governance.* FAO Agricultural Development Economics Policy Brief 31. Rome.

Governance and policies for sustainable and equitable irrigation and use of water

The adoption of integrated technical solutions requires policy coherence and clear priorities. This should be accompanied by improved water governance to guarantee equitable access, in a situation of increased demand for water, while preserving water-related environmental services. Possible governance and policy priorities to address water scarcity in irrigated agriculture include the following.

- **Introducing transparent allocation systems** to balance water use for food production, the basic needs of vulnerable populations and the preservation of water-related environmental services. Establishing secure water tenure and rights and ensuring ecosystem services can empower users, promote efficient water use and open opportunities for water markets, provided institutions and enforcement mechanisms operate properly.
- **Investing in integrated data and information systems** that are open and transparent can inform efficient water allocation systems and ensure long-term sustainability of water use. Multidisciplinary and inclusive dialogue to find balanced solutions requires reliable data on the availability and use of water.[1]
- **Establishing or empowering water users' associations that bring together users to collectively manage water.** Particular attention should be given to engaging women and non-consumptive water users (e.g. fisherfolk), who are often disadvantaged and ignored.
- **Ensuring policy coherence within agriculture and between sectors for sustainable water use.** Policies should be coordinated to navigate trade-offs between sub-sectors within agriculture – e.g. irrigated crops and inland fisheries – and across sectors, so as to strengthen synergies within and between sectors in using water efficiently and sustainably.
- **Adopting new funding mechanisms for investments in water-use efficiency.** Several factors have inhibited private sector involvement. Mechanisms to bring in private funding include: public-private partnerships; a mix of grants, government-guaranteed loans and contributions by beneficiaries; and blended finance, which uses development finance or public funding to mobilize private investments. Funding mechanisms must respect water tenure and rights, especially of small-scale farmers.
- **Realigning private incentives** with true costs by adjusting prices and phasing out general subsidies. Trade distortions that encourage production of water-intensive crops and unsustainable use of water should also be removed. Payments for environmental services can help realign incentives to preserve ecosystems functions.

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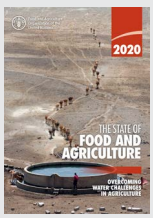

The findings in this brief have been adapted from the FAO report *The State of Food and Agriculture 2020. Overcoming water challenges in agriculture* available at www.fao.org/publications/sofa

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