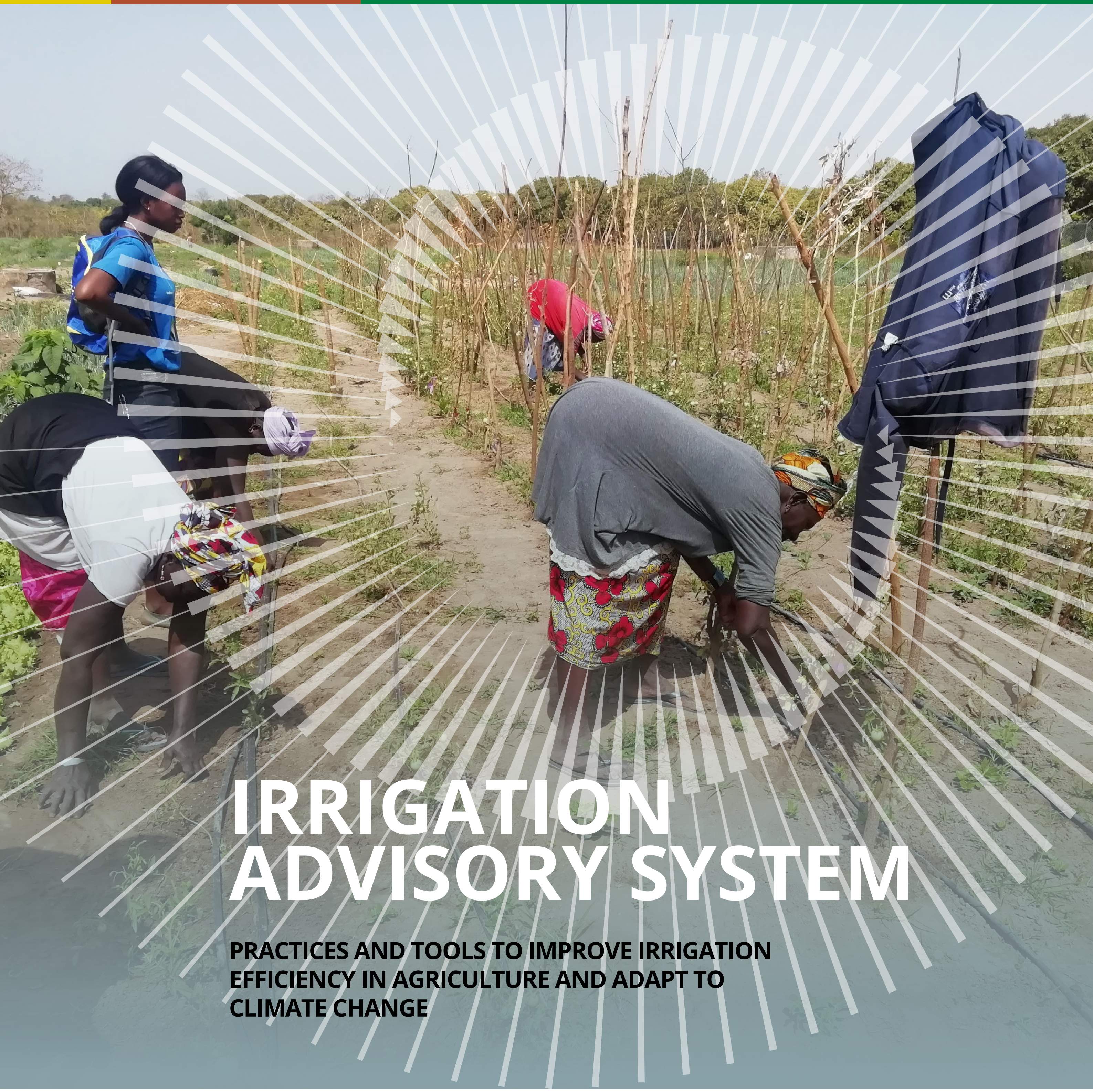
TECHNICAL SHEET

CLIMATE SMART
AGRICULTURE AND
AGROECOLOGY
BEST PRACTICES



IRRIGATION ADVISORY SYSTEM

PRACTICES AND TOOLS TO IMPROVE IRRIGATION EFFICIENCY IN AGRICULTURE AND ADAPT TO CLIMATE CHANGE

EXPERTISE FRANCE
GROUPE AFD

GCCA+
THE GLOBAL CLIMATE CHANGE ALLIANCE PLUS INITIATIVE

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INTRODUCTION

The Irrigation Advisory System is an intelligent irrigation management system (climate service) that optimizes water use, in conjunction with training in agroecological practices.

This fact sheet is based on the project implemented by the **NGO FUNDACION SUSTALDE** in The Gambia and supported by **GCCA+ WA.**

It aims to capitalize on the practice of smart irrigation.

This fact sheet was produced as part of the **Global Climate Change Alliance + (GCCA+)** West Africa project

(funded by the European Union and implemented by Expertise France, under the political and institutional leadership of ECOWAS, and with the technical partnership of CILSS) and in particular the process of capitalization of 15 pilot projects of climate-smart agriculture (CSA) and agroecology (AE) carried out by civil society organizations.

1 // DESCRIPTION OF THE PRACTICE

DESCRIPTION OF THE PRACTICE

The Irrigation Advisory System (IAS) refers to a set of measures to be put in place to improve irrigation efficiency. The system is implemented through training farmers in technical skills in agroecological practices to reduce crop water requirements and the establishment of an irrigation advisory system that provides farmers with specific irrigation recommendations for selected crops.

IAS solutions are based on information and communication technologies (ICT) and operate on the basis of information collected by agro-meteorological stations installed in the project areas. These stations collect real-time or historical weather data, soil moisture information and crop growth data. Based on this information, the system works by adjusting and calibrating a soil water balance model to estimate the actual water needs of crops and, consequently, to estimate the most appropriate irrigation frequency and amount of water to reduce evapotranspiration rates. Thus, IAS provides specific irrigation scheduling recommendations that are truly tailored to local crops and conditions.

In parallel to the implementation of an IAS, the farmers concerned are accompanied and trained in order to strengthen their skills by ensuring a transfer of knowledge in the use of data (particularly meteorological) generated by the system. The deployment of the IAS is thus ensured by raising the awareness of local farmers on the functioning of the system. In addition, farmers are trained in soil management methods to improve irrigation efficiency and reduce crop water requirements, particularly through agroecological practices.

OBJECTIVES OF THE PRACTICE

The main objective of this practice is to improve irrigation efficiency in the field to increase yields and crop quality, while optimizing water consumption and reducing the environmental impacts of agriculture.

The adaptation of an IAS to the local context is at the heart of this practice and allows, through the application of agronomic models for the calculation of crop water requirements, to provide irrigation recommendations adapted to the climatic, soil and physiological conditions specific to each farm.

Figure 1: Field irrigation system and solar pumping system

By accurately determining crop irrigation requirements, IAS should help to:

• Increase crop yields (combined with decreased crop failure) and crop quality

• Reduce water consumption and reduce water waste.

• Mitigate the impacts of crops on the environment by minimizing problems related to salinity, drainage and groundwater pollution.

The establishment of an IAS is accompanied by training of farmers in agroecological practices aimed at improving soil water retention and soil texture, limiting surface evaporation and promoting the development of microorganisms necessary for the proper functioning of soils. This training also helps build the capacity of farmers and technicians who work on irrigation systems.

The objectives of implementing an IAS go beyond crop-related issues and aim more globally to improve the socio-economic conditions of farmers.

Concrete benefits are thus observed following the implementation of an IAS accompanied by training:

✓ IAS allows for better working and living conditions. The system reduces the time spent on traditional irrigation and reduces the drudgery of the work for women (almost 90% women in the project),

✓ IAS helps increase farmers' incomes through improved yields,

✓ IAS helps increase farmers' income by adding a growing season during the wet season.

2 // HOW THE PRACTICE IS IMPLEMENTED

The deployment of IAS requires several implementation steps.

These steps have been identified through the project «Intelligent Agricultural Tools for Improving Irrigation Efficiency in The Gambia» led by Fundacion Sustalde in The Gambia.

STEP 1 // TRAINING IN AGROECOLOGICAL PRACTICES

The training takes place in several stages and is conducted in parallel with the deployment stages of the IAS. Theoretical and practical training is provided to farmers on efficient water management and agroecological practices (mulching, crop rotation and association, etc.) with the aim of optimizing the benefits brought by the implementation of an irrigation advisory system.

→ THEORETICAL TRAINING

Lack of understanding is usually the main barrier to implementing these beneficial practices, so the basics of these practices can be taught:

• Appropriate water management through the installation of drip irrigation systems to ensure localized watering.

• The addition of basic organic manure (recycled manure, compost) to increase water retention in the soil.

• Mulching crops to reduce soil drying caused by wind and sun and thus ensure better water conservation.

• Create beds for market gardening: sunken beds that concentrate water on the crop in the dry season; mounded beds that ensure good drainage and avoid excessive water risks in the wet season.

• Crop rotation to ensure permanent soil cover and maintenance of good soil texture.

• Crop association to preserve the right soil structure , maintain its water retention capacity and limit evaporation from it

→ PRACTICAL TRAINING

Next, a practical workshop is organized in-situ by local farmers already trained or by project partners on the farms to show how to apply the theoretical knowledge of the training in real environments and thus, provide farmers with concrete examples of the benefits of implementing the best agroecological practices. If necessary, a second round of workshops can also be organized to promote the assimilation and adoption of the proposed techniques by farmers.

STEP 2 // ADAPTATION IRRIGATION ADVISORY SYSTEMS TO THE LOCAL CONTEXT AND IMPLEMENTING SOLUTIONS

The main challenge in setting up an IAS is to adjust and calibrate the system to the local context, i.e. both to local characteristics and to farmers' needs and expectations, in order to ensure trust and social acceptability of the system. This adaptation of the IAS to the local context is done in two steps.

1. IDENTIFICATION AND COLLECTION OF RELEVANT DATA

First, data on the local context must be collected. This information concerns in particular:

1.1 The characteristics of the growing area. It is important to know the area, topography, soil texture and structure, type of crop, growing season and cultivation practices used.

1.2. Meteorological data. Meteorological data such as temperature, precipitation, humidity, wind speed, sunshine, and potential evapotranspiration are essential for estimating crop water requirements and adjusting irrigation recommendations.

1.3. Field data. Field data such as soil moisture measurements, water table height, salinity, and soil electrical conductivity are also needed to better understand crop water status..

1.4. Farmer preferences and constraints. Farmers' irrigation preferences and constraints, such as available water sources, labor resources, water costs, and planting schedules, must also be taken into account for irrigation recommendations to be relevant and applicable.

2. ADAPTATION AND CALIBRATION OF THE IAS

Once the data is collected, the irrigation advisory system can be calibrated and adjusted to the local context. Several steps must be followed:

2.1. Data checking: checking of the database on which the IAS will operate to perform its calculations and provide recommendations.

2.2. Assessment of crop water requirements: Based on the data collected, the Irrigation Advisory System can estimate the specific water requirements of crops at the site.

2.3.Trigger point determination: the IAS is then calibrated to ensure that the trigger points are consistent with crop types, soil characteristics and local weather conditions. Trigger points are threshold values based on collected data such as weather, soil water status and crop water requirements.

2.4. Determination of irrigation frequency and intensity: Based on crop water requirements and trigger levels, IAS can determine the frequency and amount of irrigation for each crop and provide adjusted recommendations.

STEP 3 // DEPLOYMENT OF IAS

Once the steps of calibration and adaptation of the system to the local context are completed, the IAS can be installed and deployed. The deployment of the IAS in the selected farms and cooperatives is accompanied by awareness raising and knowledge sharing on irrigation efficiency and soil management concepts.

This awareness is implemented through visits and round tables with agricultural services (extension officers), irrigation agents and research institutes.

POINTS OF REFLECTION FOR SCALING

• The technology depends on having access to water in the first place (in the case of the Fundacion Sustalde project in The Gambia, state-funded work had guaranteed long-term access to water).

• Equipment must be available locally - availability of technology and materials (pipes, taps, etc.) and investment costs must be taken into account (even if farmers are willing to invest, they must be able to estimate the real costs).

• Ensure social acceptance of new irrigation practices. For example, in The Gambia, organic techniques replaced chemical techniques, causing reluctance among beneficiaries. The demonstration sites proved to be convincing.

STEP 4 // TECHNOLOGY TRANSFER AND CAPACITY BUILDING

Capacity building and knowledge transfer to farmers is essential to ensure that farmers appropriate the system and that it is sustainable. This is based on two elements:

• Capacity building and knowledge transfer from IAS to the project partner through training modules and transferring knowledge on weather station maintenance.

•Capacity building on sustainable irrigation management for smallholders in the field of irrigation efficiency and sustainable agriculture, knowledge and access to IAS.

STAKEHOLDERS INVOLVED IN RESEARCH AND DEVELOPMENT

In addition to the project leader, other stakeholders can be involved to set up and deploy the IAS. It is thus relevant to involve research centers as well as national experts to support the implementation and monitoring of the IAS.

In the Gambia project, the National Agriculture Research Institute (NARI) was a partner in the project and was involved in the development of the tool and forecasts, and provided experts in agroecology and climate-smart agriculture.

BENEFICIARIES

The implementation and deployment of IAS solutions require the involvement of producers (men and women).

There is also a need to involve agricultural technicians to train them in the use and maintenance of IAS facilities.

TECHNICAL AND SOCIAL FEASIBILITY

IAS must be implemented by experienced project leaders who are able to build capacity and carry out technology and knowledge transfer to local farmers throughout the system's setup stage. This is essential to ensure the appropriation, acceptance and sustainability (through maintenance) of the IAS.

PROJECT SUCCESS FACTORS

According to the PDP, the project's success factors are:

- ✓ **Information sharing** and understanding of project issues/activities/expectations;
- ✓ **The mobilization of extension officers** who are the indispensable relays of technologies and techniques;
- ✓ **Ensuring that beneficiaries trust a**nd accept the new technologies: The project must benefit from social acceptance of the proposed new technologies and from the trust established between PDP and beneficiaries. This can be built on the demonstration of the successes of the first IAS-based crop cycles;
- ✓ **Enlisting highly experienced farmers** in the project who can play a leading role in implementing changes in practices.

APPLICATION CONSTRAINTS/DISADVANTAGES

There are application constraints and disadvantages related to the implementation of IAS:

⚠ **Difficulties related to the acceptance and appropriation of IAS solutions by farmers.** It is important to identify partners capable of disseminating climate information as effectively/simply as possible to farmers: «bringing climate information to the field». The technical complexity of using IAS can be a limiting factor in their appropriation by farmers.

⚠ **Challenges related to the cost of deploying an IAS.** The cost of installing, maintaining and updating IAS can be high. Significant funding is required.

⚠ **Difficulties related to access to information delivered by the IAS.** It is a question of using the right information relays (WhatsApp & radio rather than the current SMS) and equipping beneficiaries with technological tools such as smartphones or laptops.

⚠ **Difficulties related to the choice of crops concerned by the deployment of IAS:** taking into account a diversity of crops integrated in the irrigation advisory system to optimize its use and the expected benefits in terms of increased yields and reduced use of water resources.

⚠ **Difficulties related to the lack of communication and capitalization on the successes and failures of IAS deployment.** Feedback on implemented projects is often limited, which does not allow for learning from past mistakes.

DIFFICULTIES TO BE SOLVED

There are still difficulties faced in implementing IAS, such as:

🔓 **The complicated logistics of organizing the mobilization** and training of the people involved in the deployment of IAS. The challenge is to gather them, contact them, and get them to come to the trainings/workshops in order to better understand the objectives of the project (language and mobility problems). Telephone calls are not very effective; it is often a matter of going to see people.

🔓 With the new irrigation system and the training provided, farmers are encouraged to also produce in the wet season. However, this is more complicated because few suitable seeds are available on the markets. There is therefore work to be done **to facilitate access to crops that can be grown in the wet season.**

3 // CONTRIBUTION TO ADAPTATION

The use of drip irrigation based on local climatic precipitation information allows to reduce the amount of water used on crops and thus, in the long run, a less water consuming agriculture allows adaptation to climate change. Indeed, the increased efficiency of irrigation will increase the resilience of crops to the expected disruptions in precipitation as well as to the reduction in rainfall volumes.

AGRONOMIC EFFECTS/IMPACTS	• Improved crop yields through efficient water resource management and targeted crop irrigation (IAS) • Reduction of chemical fertilizer use per unit area by training farmers in agroecological practices
ECOLOGICAL EFFECTS/IMPACTS	• Reduction of water loss • Improvement of water resources • Minimization of problems related to salinity, drainage and groundwater pollution
SOCIO-ECONOMIC EFFECTS/IMPACTS (JOBS, HOUSEHOLD INCOME, HARDSHIP OF WOMEN'S WORK, SOCIAL COHESION, LAND, OTHER)	• Improved food and nutrition safety. • Improved household income and welfare • Strengthening of anticipation and adaptation capacities, and therefore greater resilience of producers • Better working and living conditions: reduction of the time spent on traditional irrigation and reduction of the drudgery of the work
NIVEAU D'ADOPTION DE LA TECHNIQUE	**Factors influencing technology adoption:** • Availability of sufficient water resources (technology that depends on prior access to water) • Availability of equipment on site and the logistics of bringing in missing equipment • Financing available to fund the purchase, installation and maintenance of the technology; • The level of appropriation of the technology by local farmers (role of farmers trained in the use of IAS in knowledge transmission and capacity building)

4 // CONTRIBUTION TO MITIGATION

The combination of IAS deployment with training and support for producers to change traditional agricultural practices to agroecological practices contributes to limiting crop-related greenhouse gas emissions, and thus to climate change mitigation. These practices contribute to climate change mitigation in a number of ways:

✓ **The use of agro-ecological cultivation methods** makes it possible to limit the use of chemical inputs (synthetic fertilizers and pesticides) whose production, transportation and application result in greenhouse gas emissions.

✓ **The reasoned and efficient use of water resources** makes it possible to save the resource and limit the emissions linked to its production, treatment and distribution.

✓ **Agroecological practices** allow for better soil conservation, for example through the implementation of crop rotation systems, plant cover or agroforestry. In this way, the practices help to maintain soil quality, reduce erosion and thus promote the storage of CO_2 in the soil. By reducing their degradation, these practices also help to maintain the carbon that was already stored in the soil.

5 // INSTITUTIONAL ASPECTS

POSSIBLE DISSEMINATION STRATEGIES

• Training of technicians and producers;

• Exchange visits between producers;

• Realization of technical sheets translated into national languages;

• Inform through publications in development newspapers and daily news magazines;

•Develop an information campaign;

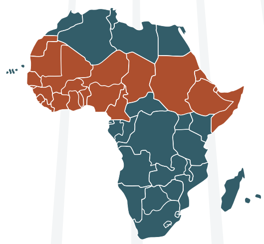
•Awareness raising and capacity building for implementing actors;

• Adopt the participatory approach in all actions related to the implementation of the practice;

• Create school fields and/or demonstration plots.

LOCALIZATION OF THE TECHNIQUE AND POSSIBLE GEOGRAPHICAL EXTENSION

The technique is applicable throughout the Sahelian and Sudano-Sahelian zone.



6 // TO GO FURTHER

CONTACTS

**NGO FUNDACION SUSTALDE Gambie // **https://sustalde.org
Contact : Pello Alfonso Muniozguren - p.alfonso@sustalde.org

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PROJECTS RELATED TO THE DEVELOPMENT OF IRRIGATION ADVISORY SYSTEMS:

The IrriGambia project, porté par Fundacion Sustalde (dans le cadre de GCCA+AO).
Available: https://sustalde.org/projects-irrigambia/

Regional Support Project for the Sahel Irrigation Initiative (PARIIS).
Available: https://pariis.cilss.int/

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CONTACT

Agence Régionale pour l'Agriculture et l'Alimentation (ARAA CEDEAO)
83, rue des patures, Super Taco - Lomé - Togo
E-Mail : araa@araa.org

To know more about GCCA+ WA : www.araa.org

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CILSS - Centre Régional AGRHYMET (CRA)
Boulevard de l'Université
BP 11011 Niamey - Niger
E-Mail : administration.agrhymet@cilss.int

https://agrhymet.cilss.int/