© Helvetas Tajikistan

Participant of the young irrigation specialist programme of the WAPRO project checks the correct water flow at the short furrow demonstration plot in Bogdor (Spitamen district, Tajikistan)

WATER SAVING TECHNOLOGIES IN RICE AND COTTON PRODUCTION

Summary of insights from six countries and eight years

Agriculture uses 70% of the world's water. As global population increases and climate changes, the threat of water and food shortages is a growing reality. To address this, a multi-stakeholder initiative was launched in 2014 to improve water productivity in agriculture: WAPRO. Under the lead of HELVETAS Swiss Intercooperation, a consortium of standard actors, large international, but also smaller domestic private sector companies and CSOs implemented a broad range of water saving technologies for irrigated rice and cotton production. The programme was funded by the Swiss Agency for Development and Cooperation (SDC), with relevant in-cash or in-kind contributions from participating actors. This document summarises the key lessons learned about the most important water saving technologies employed and useful context-specific practices to maximise water savings.

HELVETAS

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development and Cooperation SDC

February 2022

WATER PRODUCTIVITY PROJECT

"WAPRO" is an eight-year project aimed at enhancing water productivity in the cultivation of rice and cotton, two of the most water-consuming crops globally. It is a joint undertaking of SDC, renowned private sector partners such as Mars and Coop, global platforms such as the Better Cotton Initiative (BCI), the Sustainable Rice Platform (SRP) and the Alliance for Water Stewardship (AWS), and numerous local private and civil society partners. The project consists of ten sub-projects active in six countries: India, Kyrgyzstan, Madagascar, Myanmar, Pakistan and Tajikistan. Helvetas has been mandated to coordinate project implementation through a "Push-Pull-Policy" approach. In its "Push component", it has worked with 65,000 farmers to help them adopt water saving technologies. Through its "Pull component", global as well as smaller domestic companies are now sourcing rice and cotton more sustainably. With its "Policy component", the project has contributed to shaping global production standards, influenced national and sub-national policies to allocate scarce irrigation water fairly, and empowered thousands of farmers to claim their right to access to irrigation water via local water stewardship actions.

Water savings achieved with technologies applied in WAPRO sub-projects

The following table summarises water productivity data and records taken from the last three years of WAPRO implementation.

WAPRO farmers are lead farmers trained and guided by field technicians on how to record the water volumes applied in irrigation. Sometimes data are also taken from field diaries implemented by the commodity standards BCI or SRP. Comparison famers are those farmers who did not apply any of the identified technologies but were trained to take water measurements and record data.

The column "monitored WAPRO farmers" and "monitored comparison farmers" gives an indication about the sample sizes that formed the basis for data aggregation. To condense the table to a comprehensible volume the mean value of the sample sizes over the project's eight-year duration is given.

A short profile of each water saving technology and its particularities for successful implementation can be found below.

Water saving technology	Usual practice (comparison group)	Country	Commodity	Standard applied	Mean sample size WAPRO farmers / comparison farmers	Minimum water saving for WAPRO farmers in last 3 WAPRO years	Maximum water saving for WAPRO farmers in last 3 WAPRO years
					No. / no.	%	%
Alternate Wetting and Drying	Flooded rice, permanently inundated	Madagascar	Rice	none	107 / 7	9.4	91.9
		India		SRP	1270 / 50	21.9	32.7
		Pakistan		SRP	79 / 60	22.2	26.5
		Myanmar		SRP	439 / 55	70.3	75.2
		India		organic	957 / 26	20.9	63.8
Laser levelling	No levelling	Pakistan	Rice	SRP	75 / 60	8.4	25
			Cotton	BCI	1500 / 100	22.5	26
Short furrow	Long furrow	Tajikistan	Cotton	BCI	3100 / 24	25.9	72.4
		Kyrgyzstan		Organic, BCI	106 / 12	11.3	64.5
Alternate furrow	Furrow	India	Cotton	BCI	1033 / 373	23.2	89.3
		Pakistan	Cotton	BCI	1500 / 100	18.1	23.2
Drip Irrigation	Flooded rice	India	Rice	SRP	20 / 20	20.4	77.6
	Furrow	India	Cotton	Organic	75 / 9	4.8	25
		Madagascar	Artemisia	none	45 / 8	61.1	70.3

SRP = Sustainable Rice Platform (www.sustainablerice.org), BCI = Better Cotton Initiative (www.bettercotton.org)

Alternate wetting and drying (AWD)

Applied in rice production in the WAPRO sub-projects in Myanmar, India, Pakistan and Madagascar

© Helvetas / Jens Soth

Profile

Contrary to common thinking, rice plants, particularly their roots, do not like to be permanently inundated. In fact, a temporary drying out until aerobic conditions reach the root zone not only improves productivity, but also saves water and potentially reduces greenhouse gas (GHG) emissions.

Specific aspects for implementation

AWD requires good management of soil structures thereby ensuring the creation of aerobic root zones during the dry cycles. Anaerobic clusters can turn out to be counteractive for yield and even generate additional methane as GHG.

The cycle for the next flush after drying is monitored with AWD tubes. Farmers need some experience to learn how to install and correctly check soil water level using these tubes.

The technology shows particular potential in combination with laser levelling as the homogeneity of germination also allows homogeneity of the root zones which in turn leads to highly effective irrigation flushes.

Laser levelling

Applied in flat laser-levelled seed beds in rice production in WAPRO sub-projects in India and Pakistan and, in the last year, also Myanmar

Applied in laser-levelled ridges in cotton production in WAPRO sub-projects in Pakistan

© Rice Partner Ltd.

Profile

Laser levelling aims to create a very even and flat seed bed to allow very homogenous germination and irrigation of rice or rice seedlings. In cotton, the technology is utilised to create very accurate ridges with a well-defined slope to optimise furrow irrigation.

Specific aspects for implementation

WAPRO conducted specific studies to assess the accessibility of the technology even for smallholders on the basis of trained service providers. The technology thus proved to be reasonable for farms as small as even one hectare.

Alternate furrow irrigation

Applied in cotton production in WAPRO sub-projects in India

© Meghal Soni, Tata Trusts

Profile

Rather than watering the plant roots with each irrigation flush from both sides, the alternate furrow concept aims to apply water per flush to only one side of the roots. This not only saves water, but also aims to stimulate strong and healthy root growth.

Specific aspects for implementation

Alternate furrow is a good example of how a simple method can still be effective.

For the farmer, it is not difficult to implement and apply as it differs minimally from usual furrow irrigation.

Particular attention should be given to correct slopes in the furrow and adequate time given for the water to reach the end of the furrow. The technology entails advantages for weed management as the non-irrigated furrow can be hoed or weeded easily.

Short furrow irrigation

Applied in cotton production in WAPRO sub-projects in Tajikistan and Kyrgyzstan

© Helvetas Tajikistan

Profile

A lot of water is inefficiently applied when irrigation water is left trickling through long furrows. The plants at the inlet are frequently over-irrigated and the ones at the end of the furrow suffer from water stress.

Short furrows allow for correct slope creation and improved and more homogenous trickling down of the water in the furrow.

Specific aspects for implementation

The creation of short furrows doubtlessly requires considerably greater investment of labour on the part of the farmers. In the WAPRO sub-projects high adoption was only achieved through good crop productivity and joint target settings within the Water User Associations (WUA) to accomplish reasonable water savings.

Drip irrigation

Applied in rice and cotton production in WAPRO sub-projects in Myanmar, India, and Pakistan and for medicinal plants in Madagascar sub-project

© Helvetas / Jens Soth

Profile	Specific aspects for implementation
Drip irrigation is by far the most efficient technology in terms of water savings. This is not new at all, but there are continuing debates as to whether the technology justifies or amortises its high investment costs particularly when applied in staple crops such as rice, of a perceived low value. WAPRO found ways to share the investment of drip irrigation between farmers and value chain actors. Occasionally, local governments also contributed funding. Thus, the investment was de-risked for the farmers.	Drip is not only demanding with regard to investment costs, but also with regard to the necessary knowledge and experience of the farmers. The correct dripper position, setting adjustments that ensure intended volumes and timings can be maintained, and the system's intertwining with other field operations are much more complex when observed with an uninitiated eye. A close and attentive extension by experienced technicians is an absolute pre-requisite for the successful implementation and long-term adoption of drip by farmers. The technology nevertheless has further potential when combined with "fertigation". This is a device that dissolves fertilizers and adds it to irrigation water, thereby combining irrigation and fertilization effectively.

OVERARCHING LESSONS LEARNED AND IMPLEMENTATION ADVICE

Tap into the saving potential

As the data in the table above show, there is a broad variation of water saving potentials, not only between the different technologies, but also between the minimum and maximum savings. The higher the difference between minimum and maximum savings is, the higher is the potential for tapping into savings with proper technical advice (see also following paragraphs). With an average saving of more than 20% and an outreach to 65'000 farmers, the project could save considerable volumes of water.

Have an irrigation system management and Water User Associations (WUA) in place that ensure timely access to irrigation water

Although it may sound trivial for irrigation experts, the overarching golden rule for each technology implemented to save irrigation water is to ensure reasonable irrigation system management or, ideally, a full water stewardship (see next paragraph) in place. A farmer who is concerned that irrigation water may not be available during a period when his/her crop is facing water stress will not stick to water saving concepts or rules. The farmer will apply more irrigation water hoping to fill his/her soil water retention capacity to the maximum thereby hoping to bridge a period of drought when irrigation water is not available. Establishing farmers' trust in their water user association or irrigation water supply scheme is key to optimising the water saving potential of a given technology.

Have a water stewardship in place

As mentioned above, an operative WUA and adequate irrigation system management are absolute minimum requirements. But in light of water scarcity challenges induced by over-use and climate change it is more appropriate to have a water stewardship in place. Water stewardship is much more than the distribution of irrigation water and its management of its use. It is a regularly revised water management and action plan based on informed decisions and actions agreed upon by all water users in a catchment or at the very least a sub-catchment area. These informed decisions and actions are jointly prepared and based on a solid understanding of and hydrological information about available water resources.

A good water stewardship also keeps an attentive eye on potential losses between water source and field. See the documents of the Alliance for Water stewardship for an even more holistic and comprehensive approach in water stewardship (www.a4ws.org).

The big achievements of WAPRO could only be accomplished by the active intertwining of water-saving measures on the field level with collective actions emerging from the corresponding water stewardship discussions.

Right timing, right volumes

WAPRO studies confirmed that, despite elaborate extension and infusion of irrigation expertise, there is still room for improvement when it comes to matching irrigation volumes with particular crop water requirements in critical vegetation periods. Thus, irrigation projects should strive to make use of the most recent crop water requirement models not only for the crop in general, but ideally for the particular varieties used on the field. To give a tangible example: Most recent crop water requirement models for cotton give rise to the highest productivity by inducing controlled water stress before the period of boll formation, but make sure that the full crop water requirement is covered during this same period.

Participatory elaboration of technology packages and corresponding extension and guidance

New irrigation technologies should always be thoughtfully embedded in the overall extension and its corresponding extension tools. The extensionists have to be particularly alert of challenges that might be specific to the most vulnerable group of poor farmers. Likewise, this technology embedding should strive to make the technology handy and comprehensible. Rather than showing manifold variations, the extension teams should aim to elaborate a few clear success factors to bring about the technology's full potential and highlight a few major pitfalls that said technology may entail and thus avoid repeated and frequent mistakes in farming realities.

It is important that the technologies are introduced properly, via field days, extension tools, and the corresponding channels for discussions with farmers to create an adapted technology package adapted to the equipment, knowledge level, and mentalities of the farmers in the project.

A wonderful technology that is simply too laborious for farmers or interferes with other working steps of the cultivation will not be adopted.

Create a dynamic link with the applied standards

Sustainability standards such as those indicated by the Better Cotton Initiative (BCI) and the Sustainable Rice Platform (SRP) entail certification elements or principles that not only address field-level water aspects. Both open interfaces to integrate water stewardship elements. In particular, BCI offers good guidance on how water stewardship can be established via the corresponding action plan templates and how collective water stewardship actions can be regularly revised with the obligatory continuous improvement templates.

Based on the eight years of WAPRO implementation, we can conclude that substantial water savings are possible if field-level and water stewardship actions are combined by all involved actors in order to obtain synergistic leverage.

Jens Soth
Senior Advisor
Commodity Projects

Peter Schmidt
Senior Advisor
Agriculture and Food

Sophie Nguyen-Khoa
Senior Advisor Water Security

HELVETAS Swiss Intercooperation

Weinbergstr. 22a, PO Box, CH-8021 Zurich
Maulbeerstr. 10, PO Box, CH-3001 Bern
info@helvetas.org, www.helvetas.org