WP2 – Introducing on-farm water saving technologies and practices

MEDWATERICE

2° Annual Meeting

Skype, 10 November 2020

ADVANCES TOWARD OBJECTIVES (BY TASK)

MAIN RESULTS ACHIVED SO FAR

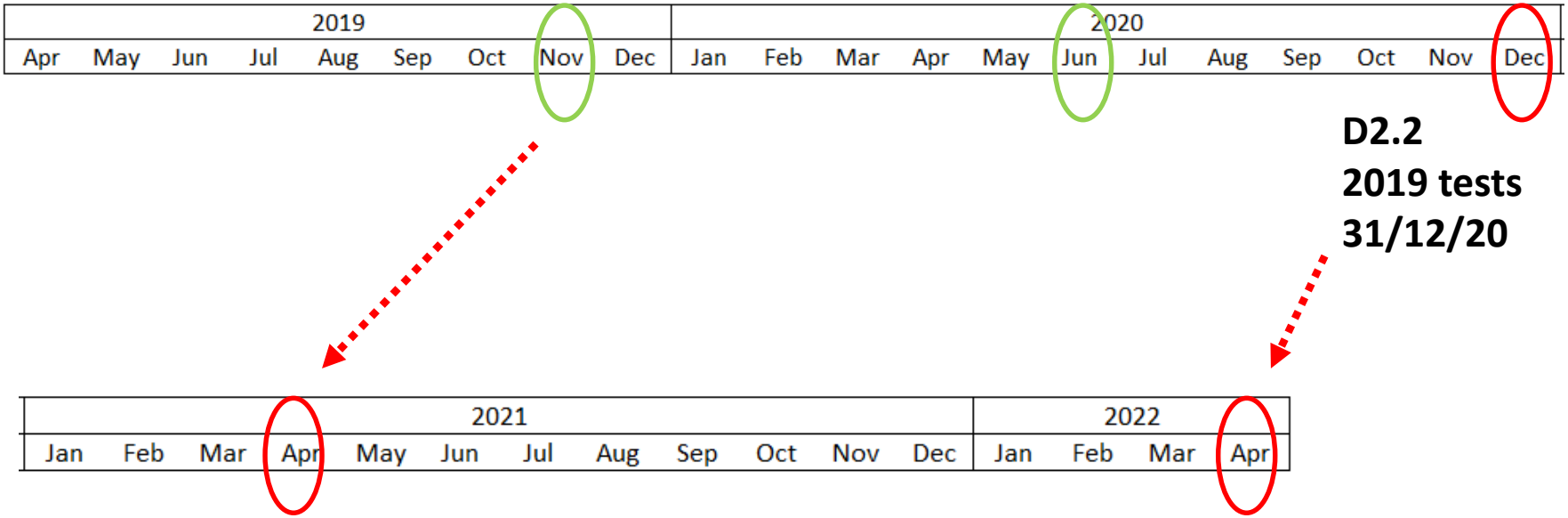
DEVIATION FROM THE PROJECT WORK-PROGRAMME

NEXT STEPS

WP2 TIME SCHEDULE AND DEADLINES

D2.1
Existing data
27/11/19

M2.1
Preliminar report 2019 tests
05/06/20



D2.2
2019 tests
31/12/20

D2.1
Updated existing data
31/04/21

D2.2
2019-2020-2021 tests
31/04/22

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ADVANCES TOWARD OBJECTIVES (BY TASK)

Deliverable 2.1 **Review on existing data on rice water consumption and environmental impacts** was submitted in November 2019 and will be updated in April 2021.

SHPs have already met and agreed on **the most appropriate irrigation management option in each area**, and experimentation on them has been (and still is) carried out in all pilot farms. **Quantification of water uses and collection of data to assess the overall sustainability** is in progress and will continue during 2021 season in many cases.

The **effects of irrigating rice with treated wastewater** are studied since 2019 agricultural season and will continue until the end of 2021.

It is worth to highlight the **common database** already built and stored in UNIMI open data repository. It allows **to benchmark data from different countries and different technologies and practices**.

ADVANCES TOWARD OBJECTIVES (BY TASK)

Case Study / Task	CS1	CS2	CS3	CS4	CS5	CS6	CS7
2.1	On-going	On-going	On-going	On-going	On-going	On-going	On-going
2.2	**Done**	**Done**	**Done**	**Done**	**Done**	**Done**	**Done**
2.3	On-going	On-going	On-going	On-going	On-going	On-going	On-going
2.4					On-going		
2.5	On-going	On-going	On-going	On-going	On-going	On-going	On-going

Task 2.1 Collect and harmonize existing data on irrigation consumption and environmental impacts of rice cultivation in countries participating in the project.

Task 2.2 Select irrigation technologies and management options most appropriate to solve problems emerged in each country with the involvement of Stake-Holder Panels.

Task 2.3 Test/demonstrate alternative irrigation options (technologies and practices).

Task 2.4 Focus on the reuse of treated waste water in rice irrigation.

Task 2.5 Collect at least a minimum dataset for each case-study.

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MAIN RESULTS ACHIVED SO FAR

Table 2.2: example of variables measured and estimated included in the common database

CS name							
Name of the experimental farm							
Experimental year							
Irrigation treatment, number of fields/plots for each treatment and their dimension	example: traditional flooding (2 plots; 0.5 ha each), or drip irrigation (2 plots; 0.7 ha the first and 1.2 ha the second), etc.						
Type of data	**Variable** (in black: Minimum Data Set; in red: additional data)	**Units**	**The variable is measured (M) or estimated (E)?**	**Time step of measurement/estimation** (hourly, daily, seasonal, five times in a season, etc.)	**Number of measurement/ estimation points** (1 for each irrigation treatment, 1 for each plot, 8 for each plot, etc.)	**Measuring device or estimation method**	**Data format** (Excel, etc.)
Irrigation	Irrigation inflow	m^3/s					
	Irrigation outflow	m^3/s					
	Irrigation water salinity	dS/m					
	Irrigation ponding water level in	mm					
	Arsenic and cadmium	mg/L					
	Total Nitrogen	mg/L					
	Nitrate	mg/L					
	Phospate	mg/L					
	Potassium	mg/L					
	Pesticides (specify which ones)	µg/L					
	Other, if any						
Other water (or nutrient, or pesticide) balance components	Rice evapotranspiration (ET)	mm					
	Percolation below the root zone	mm					
	Variation of water volume store	mm					
	Variation of water volume store	mm					
	Other, if any						
Crop evolution	Crop phenology	doY					
	Rooting depth	cm					
	Cover Fraction (CF)	%					
	Leaf Area Index (LAI)	m^3/m^3					
	Crop height	cm					
	Other, if any						

MAIN RESULTS ACHIVED SO FAR

CS1, Lomellina (Italy):

Wet seeding and traditional flooding (WFL), dry seeding and delayed flooding (DFL) and alternated wetting and drying (AWD) :

38% reduction in the total irrigation input was achieved by DFL compared to WFL. Water productivity (WP) for the two irrigation strategies were found to be 0.36 kg/m^3 and 0.54 kg/m^3, respectively.

AWD net irrigation showed to be 78% less that the amount found for WFL, while WP reached values as high 1.39 kg/m^3.

Rice grain yield was found to be comparable for any irrigation method (WFL, DFL or AWD).

Total arsenic content in grain was not significantly affected for any of the three tested irrigation strategies, but rice cadmium level was statistically higher in the AWD treatment, although under the legal limits set in the EU even for baby food.

During the crop season the concentration of herbicides clomazone and MCPA in surface water, soil solution and groundwater, were found to be close to initial concentrations before crop establishment, and always under the standard quality level imposed by the Italian legislation.

The overall trend, in herbicide concentration is an increase immediately after the specific herbicide treatment followed by a concentration decrease of both herbicides, under all irrigation strategies and in all the compartments: surface water, soil solution and groundwater.

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MAIN RESULTS ACHIVED SO FAR

CS2, Baix Ter (Spain):

Wet seeding and traditional flooding (WFL), dry seeding and delayed flooding (DFL) and subsurface drip irrigation (SDI):

An average of 13,410 m^3/ha were applied in both, 70 ha devoted to WFL and 60 ha to DFL. This corresponds to water productivities (WP) of 0.45 and 0.41 kg/ha, considering water from irrigation and water from irrigation and rain, respectively.

The SDI experimental plot showed a yield close to that obtained with WFL and DFL in commercial fields in a portion of field with loam soil texture, but in the field portion with coarser soil texture yield was severely reduced. WP in SDI and loam soil texture achieved 0.73 and 0.62 kg/ha considering water from irrigation and water for irrigation and rain, respectively.

Sandier soil textures have shown drawbacks for SDI due to water deep drainage losses and the difficulty of raising water to root zone, especially in early stages of rice. The need to apply high irrigation water volumes compromises potential water savings expected in SDI compared to WFL and DFL.

Design parameters have been critical, showing adequate values at 66 cm and 30 cm spacings for driplines and emitters, respectively, and 15 cm dripline depth. Irrigation criteria for the SDI must allow to maintain soil water potential at values close to -10 kPa, which corresponds to field capacity for aerobic rice.

Arsenic and cadmium were in all cases below the legal values.

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MAIN RESULTS ACHIVED SO FAR

CS3, Lower Guadalquivir Valley (Spain):

WFL (CONTROL – usual flooding irrigation), LDP - lengthening drying periods, Reduction Treatment 1 (RT1) – 25% reduction in water inflow/outflow during whole crop cycle; Reduction Treatment 2 (RT2) – 20% reduction in water inflow/outflow from day 100 after sowing and DRIP-drip irrigation.

Water supply estimated for treatments WFL-CONTROL, RT2, RT1, LDP and DRIP were: 41,446; 35,981; 32,156; 24,945 and 27,484 m^3/ha, respectively.

Grain yield for the treatments WFL-CONTROL, RT2, RT1, LDP and DRIP were: 9,070; 8,963; 8,759; 8,795 and 5,400 kg/ha, respectively. The corresponding WP, considering uniquely the irrigation were: 0.22, 0.25, 0.27, 0.32 and 0.20 kg/m^3, respectively.

In flooded treatments, mean seasonal salinity was correlated with the Relative Irrigation supply, and, in turn, yield was correlated with salinity. Maximum yield was obtained in WFL-CONTROL and minimum in LDP-RT3, the treatment that received less water.

Results of DRIP treatment were not conclusive due to difficulties in the water management. However, the experience showed that rice production using drip irrigation is technically feasible.

Arsenic content in DRIP treatment was below the detection level, while in all other treatments it was between 0.32 and 0.39 mg/kg.

MAIN RESULTS ACHIVED SO FAR

CS4, Lower Mondego (Portugal):

The following irrigation strategies were considered in CS4: wet seeding and traditional flooding (WFL) and alternated wetting and drying (AWD) but the irrigation strategy in AWD was changed in order to control the weeds.

The irrigation water applied was 12,460 and 13,620 m^3/ha for plot WFL and AWD, respectively.

Rice grain yield was 8,800 and 8,700 kg/ha for plots WFL and AWD, respectively, therefore taking into account that precipitation from June to September accounted for 694 m^3/ha, WP were of 0.67 and 0.61 kg/m^3 respectively.

Arsenic and cadmium contents in the rice grain were 0.99 and <0.010 mg/kg in both treatments.

MAIN RESULTS ACHIVED SO FAR

CS5, Lis Valley (Portugal):

For WFL treatment, irrigation water accounted 14,150 m^3/ha with a WP, considering water from irrigation and rain, of 0.50 kg/m^3.

When using treated wastewater (TWW) for irrigation average faecal coliform value of 143 NMP / 100mL, exceeding the maximum recommended value (MRV) recommended by the Portuguese legislation, which is 100/100mL (Portuguese Irrigation Water Quality Legislation, 1998).

The use of TWW in the rice crop does not show increased risks for public health, however the irrigation method must be adapted, in particular to SDI to avoid human and animal contact to certain residues in this type of water, and thus, Safeguard Food and Environmental Security.

CS6, Delta Nile (Egypt):

In process.

CS7, Bafra Valley (Turkey):

In process.

DEVIATIONS FROM THE WORK PROGRAMME

CS	Deviation from the work programme	Reason	Corrective action or mitigation measure
CS1	Testing water saving potential, energy consumption and labour reduction of on-farm water management automation technologies not implemented up to date.	Funds not available up to date.	Tests could be carried out if funds arrive on time.
CS2	Water, nitrates/phosphates and salts balances not performed during 2019 due to lack of outflow measurements in a 130 ha productive farm irrigated by continuous flooding (Mas Pla farm). Drainage water discharge quantity and quality to assess the possibility to reuse it through pumping it back to the irrigation network was not assessed during 2019 in Mas Pla farm.	Funds not available during 2019 season. Funds not available during 2019 season.	Outflows were measured during 2020 and will continue during 2021 season. Drainage was measured during 2020 and will continue during 2021 season.

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DEVIATIONS FROM THE WORK PROGRAMME

CS	Deviation from the work programme	Reason	Corrective action or mitigation
CS3	4 water saving techniques were implemented (different water inflow/outflow reduction combined with longer drying periods -RT1, RT2, LDP-RT3-, Drip Irrigation –DI-) on top of the traditional irrigation during 2019 season.	SHP considered they were all worth testing and original experimentation plan was extended.	Quantity of water saving techniques tested increases from the original workplan.
	Assessing the possibility to reuse water drainage water though pumping it back in the irrigation network (2 farms) was not carried out during 2019.	Solar pumps were stolen and high salinity made SHP decide to cancel this test.	4 water saving techniques were implemented during 2019 and 3 of them will continue during 2021 season.
	Testing water saving potential, human labour reduction and economic sustainability of on-farm water management automation technologies (2 farms) was not carried out during 2019.	SHP decided to change since operation within the Irrigation Community is manual.	4 water saving techniques were implemented during 2019 and 3 of them will continue during 2021 season.

DEVIATIONS FROM THE WORK PROGRAMME

CS	Deviation from the work programme	Reason	Corrective action or mitigation
CS4	Testing water consumption of water saving irrigation option (AWD) was not carried out during 2019.	Monitoring during first season was a priority due to uncertainties impacting yield (weeds and pests).	2020 tests were carried out implementing AWD and will continue during 2021.
	Improving soil and water management techniques for each irrigation option (Bico da Barca) not performed during 2019 season.	2019 tests were limited by soil conditions (high permeability).	Experimental tests were carried out in different plots in the same location during 2020 and will continue during 2021 season.
	Testing the use of urban treated wastewater coming from a WWTP located in the area on rice irrigation, assessing yield impact, health and ecotoxicological risks (laboratory and plots in a farm) was not carried out.	Task included in CS5.	Lab tests using treated WW was performed in CS5.

DEVIATIONS FROM THE WORK PROGRAMME

CS	Deviation from the work programme	Reason	Corrective action or mitigation
CS5	Testing water consumption of water saving irrigation option (AWD) was not carried out during 2019.	Dry seeding process failed.	2020 tests were carried out using traditional seeding and will continue during 2021 season.
	Surface Drip Irrigation tests were not completed.	Dry seeding failed. Underground water to shallow.	Test plot was changed and experimentation was carried out during 2020 and will continue during 2021.
	Testing the use of urban treated wastewater coming from a WWTP located in the area on rice irrigation, assessing yield impact, health and ecotoxicological risks (laboratory and plots in a farm) was not carried out.	SHP decided not to work at field scale due to legal restrictions.	Lab tests using treated WW was performed during 2019 and 2020 and will continue during 2021 season.

DEVIATIONS FROM THE WORK PROGRAMME

CS	Deviation from the work programme	Reason	Corrective action or mitigation
CS6	No data is available to assess deviations from work programme in CS6		
CS7	Optimizing soil/irrigation and crop management for each irrigation option (experimental BARI farm) was not performed during 2019 season.	2019 tests were focused at implementation of irrigation options.	Improvements were performed during 2020 tests and will continue during 2021 season.
	Testing the effects of different irrigation options on Greenhouse Gases emissions (CH_4 and N_2O) (BARI farm) was not carried out during 2019 season.	Measurement equipment not available.	2020 tests were carried out and will continue during 2021 season.

NEXT STEPS

- Receive CS6 and CS7 articles from all CSs to prepare D2.2 (2019 data)
- Collect data from all CS Leaders to update D2.1 (existing data)
- Collect 2020 experimental data
- Prepare 2021 tests (some CSs)
- Data curation

THANKS FOR YOUR ATTENTION