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FACTSHEET

PADDY RICE MANAGEMENT PRACTICES TO PROTECT WATER RESOURCES IN THE LOWER MONDEGO VALLEY: IMPROVED CONTINUOUS FLOODING (WFL) AND ALTERNATE WETTING AND DRYING FLOODING (AWD) IRRIGATION

WHAT IS WFL AND AWD?

WFL - **Improved wet seeding and continuous flooding** - Paddies are initially flooded to prepare the wet sowing and continuous flooding, with ca. 10 cm of ponding depth, and a frequency varying from daily to a few days. They are highly demanding water due to significant deep percolation, and surface drainage. The flooding of paddies plays several determinant roles: (i) temperature regulation during the first weeks of crop development, due to microclimatic imperatives, particularly during night-time in the initial phase of the cycle and during flowering; (ii) after sowing, to avoid seed collecting by wild birds; (iii) control of weeds development; (iv) control of the crop damage due to the strong wind; and (v) soil salt leaching in susceptible areas. In its turn, the initial drainage periods enable, for example: (i) the application of phytopharmaceuticals, especially herbicides and fungicides; and (ii) a good rooting of the seedlings, while avoiding soil hardening, and a reduction of algal proliferation on surface water.

AWD - **alternate wetting and drying flooding** - is a flooding irrigation method that aims to save water compared to WFL by using a sequence of irrigation cycles followed by drying periods; during these periods, the recession of water from the flooded soil is due only to infiltration and evaporation, leaving the soil in a non-saturated condition in its surface layer for a few days; limits are established for the soil drying condition through the level that water can reach below the soil surface, or the matric tension at a certain depth in the unsaturated layer, or the size of the soil cracks; once the limit is reached, a new irrigation event is carried out to flood the plot, thus replenishing a thin layer of water on the soil, 5 to 10 cm thick; in this way, the volume of water applied to irrigation is limited compared to traditional practices, due to reduced percolation and evaporation, resulting in reduced greenhouse gas emissions due to improved aeration conditions in dry soil.

EXPERIMENTAL SCHEME

Several Rice Pilot Farms were monitored during the period 2023-2025, observing the field water level (FWL), irrigation depth, crop evapotranspiration, precipitation during crop season, and paddies surface drainage. The paddy water balance method was applied to calculate deep percolation. Crop monitoring and production measurements were conducted. Several physicochemical parameters were observed, such as electrical conductivity, ammoniacal nitrogen, and nitrates, being the layout of water monitoring at farm level presented in Figure 1.

This project is part of the PRIMA programme supported by the European Union

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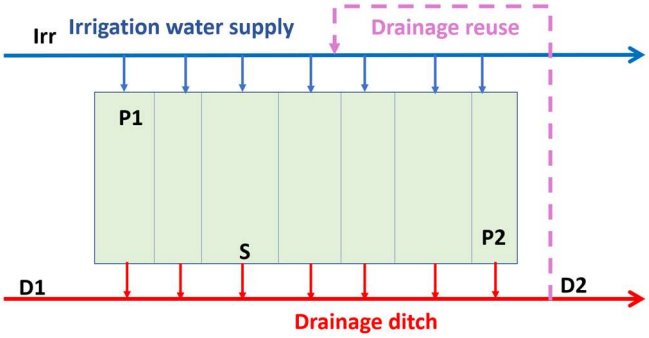


Figure 1 – Layout of water monitoring at farm level. Legend: Irr - irrigation depth, D1, D2 – upstream/ downstream, surface drainage ditch, P1, P2 – upstream/downstream subsurface water collected through piezometers 2.5 m depth, S = paddy surface drainage.

EFFECTS ON IRRIGATION WATER USE AND ON LAND PRODUCTIVITY

The average values of water irrigation use per BMP (Figure 2), and productivity (Figure 3), reveal that WFL and AWD have good performance.

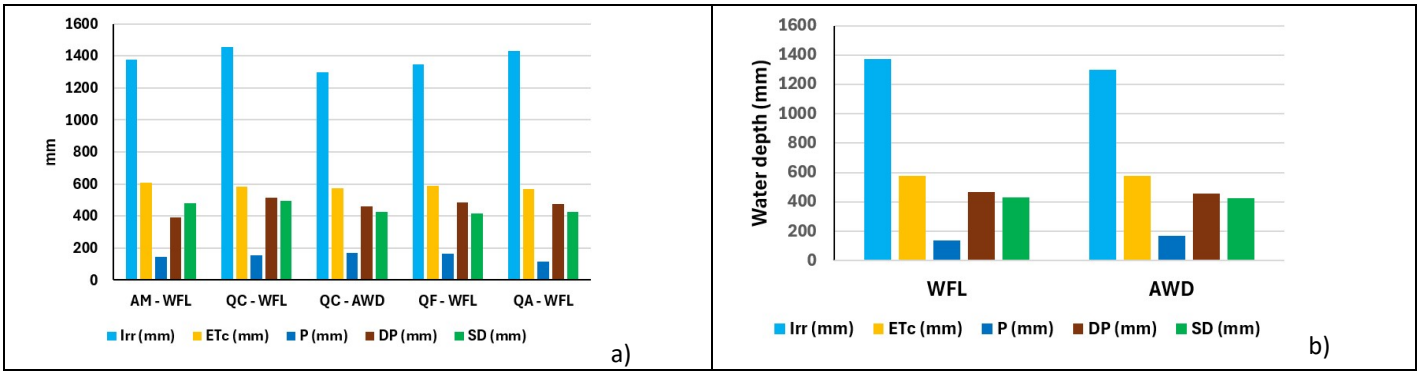


Figure 2. Values of water irrigation use: a) average value per farm and per BMP; b) average values per WFL and AWD BMPs. Legend: Irr – irrigation depth, ETc – crop evapotranspiration, P – precipitation during crop season, DP – paddies deep percolation, SD – paddies surface drainage

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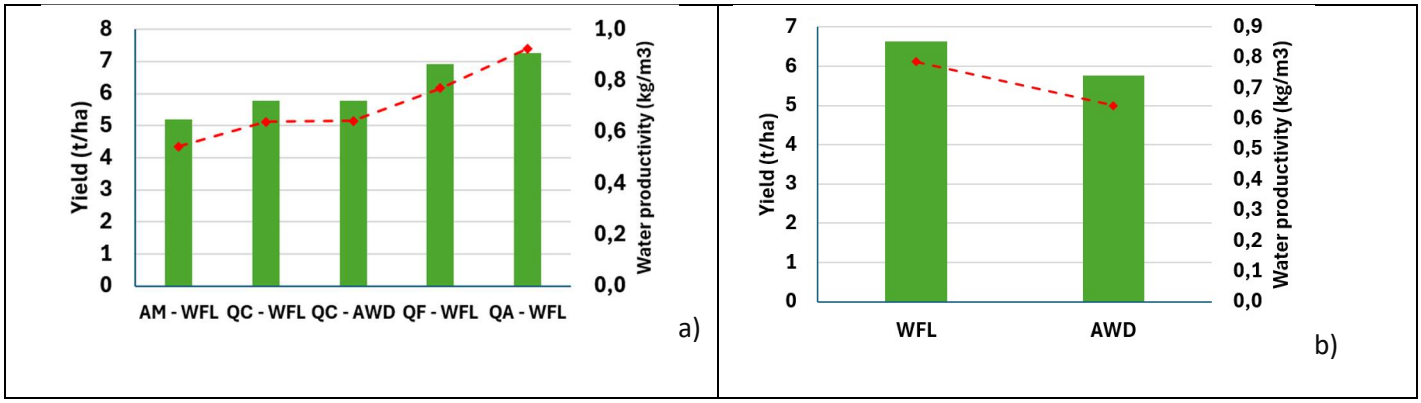


Figure 3. Values of yield or land productivity (ton/ha, whole grain 14% humidity): a) average value per farm and per BMP; b) average values per WFL and AWD.

The average values: i) Irrigation depth - WFL 1370 mm and AWD 1300 mm (less 5%); ii) Surface Drainage - WFL 429 mm and AWD 427 mm (less 0.5%); iii) Deep Percolation - WFL 470 mm and AWD 459 mm (less 4.5%).
Observed acceptable values of IWU, due to good quality of precision land levelling with laser control, and usual reduced field water level (FWL). However, FWL also depends on dynamic crop management criteria that sometimes-advised higher depth values, such as strong winds, very high air temperatures, weeds, and control of seed loss by wild birds. The average land productivity was 6.6±0.94 t/ha for WFL and 5.7±0.10 t/ha for AWD. It was also observed that land productivity has a stronger relationship with farm location area, due to soil texture and quality, and microclimatic conditions.

EFFECTS ON NITROGEN WATER POLLUTION

Results effects on nitrogen pollution are presented in Figure 4, showing the average value of nitrates and ammoniacal of WFL. Homologous results for AWD could not be obtained, given that this BMP was applied to a very limited extent.

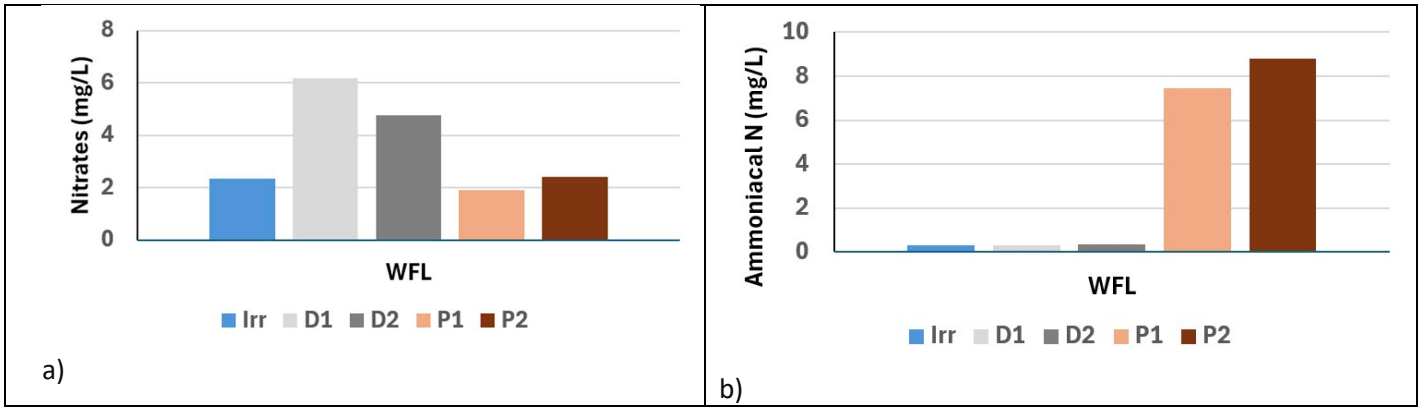


Figure 4. Average values of nitrates and ammoniacal of WFL.

It was observed that nitrates reduced on surface drainage from upstream D1 to downstream D2, showing a beneficial effect of the rice paddy on SD. On the contrary, on subsurface water, the nitrate values increase from upstream P1 to downstream P2. Although the increase in nitrate concentration in subsurface water is small, this result highlights the

importance of better rationalizing nitrogen fertilization. Furthermore, reducing nitrates in surface drainage water mitigates the problem of contamination of downstream water resources. The ammoniacal nitrogen in irrigation water and surface drainage has very low values, and on the contrary, higher values were found in the subsurface water, increasing from upstream P1 to downstream P2, reflecting the effect of significant fertilization with ammoniacal nitrogen.

MANAGEMENT RECOMMENDATIONS

1. Carefully maintain soil preparation and precision land levelling practices, allowing for rigorous control of field water levels and water saving.
2. Monitor the electrical conductivity of irrigation and drainage water, especially in high-risk areas, to mitigate the negative effects of salinity.
3. Although AWD has little acceptance due to the risk of production loss, it should be an option to apply because of its benefits in water conservation and control of greenhouse gas emissions.