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Alternate wetting and drying irrigation for rice: first experimental activities in northern Italy

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Italy is Europe's leading rice producer, with over half of the total production, almost totally concentrated in a large paddy rice area in the north-western part of the country, stretching across the border between the Lombardy and Piedmont regions in the Po river valley. In this area, rice irrigation has been traditionally carried out by wet seeding and continuous flooding. The introduction of alternative water-saving irrigation strategies could reduce water needs and environmental impacts; however, before extensively adopting them, their effects at both the field and irrigation district scales must be quantified.

In the context of the MEDWATERICE project (PRIMA-Section2-2018), in the agricultural season 2019 an experimental platform was set-up in a location within the paddy area (Pavia province), to compare different irrigation strategies: wet seeding and traditional flooding (WFL), dry seeding and delayed flooding (DFL), and a 'safe' wet seeding and alternated wetting and drying (AWD). Six plots of about 20 m x 80 m each were set-up, with two replicates for each irrigation option. One out of the two replicates was instrumented with: water inflow and outflow meters, piezometers, tensiometers, and water tubes for the irrigation management in the AWD plots. A soil survey was conducted before the agricultural season (EMI sensor and physico-chemical analysis of soil samples). Periodic measurements of crop biometric parameters were conducted. Nutrients (N, P, K) and two widely used pesticides (Clomazone, MCPA) were measured in irrigation water (inflow and outflow), groundwater, and porous cups installed at two soil depths (20 and 70 cm, above and below the plough pan). Finally, rice grain yields and quality (As and Cd in the grain) were determined. The experimental activity in the platform was carried out for two years (2019 and 2020), and an upscaling of the results at the irrigation district scale is foreseen in the project.

Soil water balances at the field scale were computed through an approach integrating field measurements of irrigation flows and storages with hydrological modelling, to compare the three irrigation management strategies under similar soil conditions. Results for 2019 showed that DFL

allowed a water saving of 10% compared to WFL, while a higher water saving (19%) was achieved with AWD, as expected. Rice grain yield was found to be comparable for all the investigated irrigation treatments. Also, the grain N content was not significantly affected by the water management strategy adopted: the highest values were obtained in WFL and AWD (1.4 N%), while the lowest in DFL (1.2 N%). Total As in grain was not significant for any of the irrigation strategies, but rice Cd level was statistically higher in AWD, although under the legal limits set in the EU even for baby food. As far as water quality is concerned, in surface water, soil solution and groundwater, concentrations for both herbicides did not reach significant values, even after treatments, except in limited cases that could depend on relevant concentrations already present in the irrigation inflow. Data for 2020 are under elaboration and first results will be illustrated during the conference.