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WATER BALANCE OF RICE PLOTS UNDER THREE DIFFERENT CULTIVATION METHODS: FIRST SEASON RESULTS

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In the last years the rice cultivation methods has experienced worldwide a dramatic change as a consequence of the introduction of new water-saving methods in addition to the traditional flooded approach. This change concerned also the ancient rice-cultivated territories of North-West of Italy, where rice has been traditionally cultivated as flooded and where paddy fields are probably the strongest landscape landmark and represent a central feature in the nature protection networks. The new techniques introduced in these territories consist in a dry seeding followed by field flooding after about one month (third-fourth leaf), and in a full aerobic cultivation with intermittent irrigations. Despite the potential consequences of an extensive adoption of the new techniques on water requirement and on environment and landscape characteristics, as well on irrigation service organization, the dynamics of water fluxes related to the cultivation methods is still poorly investigated, especially in Italian ancient rice systems. This paper, aiming to contribute in filling such gap, presents the results obtained after the first year of a monitoring activity carried out at the Ente Nazionale Risi Experimental Station of Castello d'Agogna (PV) on three experimental plots, where each plot has been cultivated following one of the three above mentioned techniques. The monitoring system, presented in a companion paper, in fact allowed to collect all the data (by direct measurement or by indirect estimation) required for the water budget calculation. The results showed that the water requirement in terms of evapotranspiration is fundamentally the same in the case of traditional flooded cultivation and dry seeding, whereas it is about 17% less for the aerobic rice. More relevant, the aerobic technique fundamentally annul the vertical flux towards groundwater, greatly reducing the global water requirement of rice, but at the same time eliminating any recharge of the water table. This evidence on one hand represents a significant point in reducing water requirement at field scale, but on the other the absence of the ground water recharge term should be seriously considered when the global water budget has done at the regional scale.

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EFFECT OF DIFFERENT PLANT SPECIES IN PILOT CONSTRUCTED WETLANDS FOR WASTEWATER REUSE IN AGRICULTURE

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In this paper the first results of an experiment carried out in Southern Italy (Sicily) on the evapotranspiration (ET) and removal in constructed wetlands with five plant species are presented. The pilot plant used for this study is made of twelve horizontal sub-surface flow constructed wetlands (each with a surface area of 4.5 m^2) functioning in parallel, and it is used for tertiary treatment of part of the effluents from a conventional municipal wastewater treatment plant (trickling filter). Two beds are unplanted (control) while ten beds are planted with five different macrophyte species: Cyperus papyrus, Vetiveria zizanoides, Myscanthus x giganteus, Arundo donax and Phragmites australis (*i.e.*, every specie is planted in two beds to have a replication). The influent flow rate is measured in continuous by an electronic flow meter. The effluent is evaluated by an automatic system that measure the discharged volume for each bed. Physical, chemical and microbiological analyses were carried out on wastewater samples collected at the inlet of CW plant and at the outlet of the twelve beds. An automatic weather station is installed close to the experimental plant, measuring air temperature, wind speed and direction, rainfall, global radiation, relative humidity. This allows to calculate the Reference ET (ET0) with the Penman-Monteith formula, while the ET of different plant species is measured through the water balance of the beds. The first results show no great differences in the mean removal performances of the different plant species for TSS, COD and E.coli, ranged from, respectively, 82% to 88%, 60% to 64% and 2.7 to 3.1 Ulog. The average removal efficiency of nutrient (64% for TN; 61 for NH4-N, 31% for PO4-P) in the P.australis beds was higher than that other beds. From April to November 2012 ET measured for plant species were completely different from ET0 and ETcontrol, underlining the strong effect of vegetation. The cumulative evapotranspiration highest value was measured in the CWs vegetated with P.australis (4,318 mm), followed by A.donax (2,706 mm), V.zizanoides (1,904), M.giganteus (1,804 mm), C. papyrus (1,421 mm).

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MONITORING WATER FLUXES IN RICE PLOTS UNDER THREE DIFFERENT CULTIVATION METHODS

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In the last years the rice cultivation methods has experienced worldwide a dramatic change as a consequence of the introduction of new water-saving methods in addition to the traditional flooded approach. This change concerned also the ancient rice-cultivated territories of North-West of Italy, where rice has been traditionally cultivated as flooded and where paddy fields are probably the strongest landscape landmark and represent a central feature in the nature protection networks. The new techniques introduced in these territories consist in a dry seeding followed by field flooding after about one month (third-fourth leaf), and in a full aerobic cultivation with intermittent irrigations. With the aim to study water fluxes under the three above mentioned techniques, three experimental plots at the Ente Nazionale Risi Experimental Station of Castello d'Agogna (PV) have been instrumented. In this paper the experimental framework, which presents some degree of innovation, is described in detail. In each plot (about 2000 m2) the following instruments have been installed: 1) a long throat flume with a pressure transducer for inputs, 2) an interchangeable double shaped (V-notch and rectangular) thin plate weir with a pressure transducer for outputs, 3) two piezometers and one double-depth piezometer with pressure transducers for groundwater levels, 4) one water level transducer for field water level measurement (only in flooded fields), 5) one and three groups of four tensiometers respectively in flooded and aerobic fields, 6) one multiple depth probe for water content measurement coupled with each tensiometer group (in flooded fields only for the dry period), 7) one eddy covariance station for vapour fluxes estimation (a full meteorological station was already available at few hundred meters from experimental plots). All the instruments of each plot have been connected by cables to a wireless data logger that, in turn, send the data to a PC placed within ENR offices and web-connected by a LAN. In this way, besides the automatic download of data, it was possible to remotely control the devices, to quickly fix troubles, and to better plan the field trips. The management of the whole framework was done by a specifically developed software.