



## EFFECT OF CROP INTENSIFICATION ON WATER AND NITROGEN USE EFFICIENCY UNDER IRRIGATED CONDITIONS

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Intensification of irrigated agriculture is a need to provide enough food to a growing world population. However, the agrosystems must be able to decrease their environmental impact on air, soil and water resources through an efficient use of water and nitrogen. Thus, four rotations with different degree of crop intensification were compared during two seasons (2018 and 2019) in terms of productivity, water use efficiency, and nitrogen use efficiency in a drainage lysimetric installation and for two soils with different soil water holding capacity (Deep: 125-cm depth, and Shallow: 50-cm depth). The treatments were: a long season maize in monoculture (LSM), a long season maize with a leguminous cover crop (common vetch or peas) during the winter period (CC+LSM), and a double cropping of a short-season maize preceded with winter barley (B+SSM) or with peas (P+SSM). A completely randomized experiment with three replicates (lysimeters) was used for each soil type. Nitrogen rates and irrigation water were managed according to expected crop necessities. Total aerial biomass (TAB), grain yield (GY), water use efficiency (kg TAB or GY mm<sup>-1</sup> evapotranspired water), nitrogen use efficiency (kg N uptake in TAB kg<sup>-1</sup> N applied), and N losses by drainage (kg N leached ha<sup>-1</sup>) were evaluated for each rotation. The soil type did not influence the WUE of the different treatments. In both seasons, the B+SSM presented higher WUE in terms of TAB (between 17 to 60%) and in terms of GY (between 17 to 38%) than the other treatments. The Shallow soil presented much lower NUE than the Deep soil, although the difference was smaller for the double cropping systems. Depending on the rotation treatment, N leaching in the Shallow soil was 2 to 8.5 times higher than in the Deep soil. The P+SSM presented higher NUE compared to the other treatments irrespective of season and soil type. The double cropping B+SSM had lower N leached than the other treatments but the double cropping P+SSM presented similar or higher N leached than the LSM rotations. Intensification of crops in the rotations can improve WUE and NUE but the N inputs (in amounts and time) associated to N fixation by leguminous crops included in the rotation has to be properly considered to avoid unwanted environmental impacts.

**Keywords:** *double cropping, cover crops, nitrogen use efficiency, water use efficiency*