EGU22-8093
EGU General Assembly 2022

Can an agro-hydrological model improve the irrigation management of maize under a center pivot?

Arianna Facchi[1], Alice Mayer[1], Bianca Ortuani[1], and Alberto Crema[2]
[1]Department of Agricultural and Environmental Sciences (DiSAA), University of Milan, Milan, Italy (arianna.facchi@unimi.it)
[2]Institute for Electromagnetic Sensing of the Environment (IREA), Italian National Research Council, Milan, Italy (crema.a@irea.cnr.it)

Plain areas of Northern Italy are characterized by a strong agricultural and zootechnical vocation. In the Lombardy region, the total utilized agricultural area (UAA) is about 700,000 ha, 72% of which is irrigated. Globally, about one half of the UAA is cropped with maize, but in some provinces this crop reaches almost the totality of the UAA. Maize is typically irrigated by border irrigation; however, in the context of the climate change and of the increased competition for the use of water in the plain, it is crucial to optimize the use of this resource.

This study is aimed at demonstrating the applicability of Precision Irrigation approaches in a large farm located in the core of the maize basin of the Lombardy plain (La Canova farm, BS, Italy; http://lacanovasrl.it/). In the farm, irrigation is provided by center pivots and linear irrigation systems. Although sprinkler irrigation can reduce the applied irrigation volumes compared to border irrigation, at present, a uniform irrigation rate is provided at fixed time intervals without accounting for spatial heterogeneity of soil or crop development.

During the agricultural season 2021, in a 15 hectares surface cropped with maize under a center pivot the irrigation was applied following a variable-rate approach. The soil variability was investigated using an Electromagnetic induction (EMI) sensor; through the application of cluster analysis techniques to the EMI survey, four types of soils were detected and characterized through a traditional soil sampling. According to soil variability and pivot geometry, four management zones (MZ) were identified: two MZs were characterized prevalently by coarse soils while the other two by medium-fine soils. In one 'coarse' MZ and one 'fine' MZ the irrigation was managed with the support of soil probes installed at two depth, and by a physically based agro-hydrological model (SWAP, https://www.swap.alterra.nl/) fed with weather forecasts at 7 days (https://www.abacofarmer.com/). A MATLAB code was developed to run the whole modelling system. Irrigation in the other two MZs was applied by the farmer according to the farm's typical management (about 25-30 mm every four days). In the MZs managed with Variable Rate irrigation, the model was used to identify the optimal water depth to be applied at each irrigation event, depending on the soil water balance computed for the following 5 days; in doing this, a 4-day turn and a minimum irrigation depth of 18-25 mm (as a function of the time of the season) were respected, since they were constraints imposed by the farmer. Despite the constraints, compared to the reference MZs, the approach adopted led to a water saving of about 20 and 25% for the

‘coarse’ and ‘fine’ MZs, respectively, without a loss of yield. In the next step, the approach adopted will be used to estimate the water and energy saving achievable at the farm scale.