Geophysical Research Abstracts
Vol. 15, EGU2013-9258, 2013
EGU General Assembly 2013

Adaptive management of irrigation and crops' biodiversity: a case study on tomato

Francesca De Lorenzi (1), Silvia Maria Alfieri (1), Angelo Basile (1), Antonello Bonfante (1), Eugenia Monaco (1), Maria Riccardi (1), and Massimo Menenti (2)

(1) Institute for Mediterranean Agricultural and Forest Systems - Italian National Research Council (ISAFoM-CNR) Ercolano (NA), Italy (francesca.delorenzi@cnr.it), (2) Department of Geoscience and Remote Sensing, Delft University of Technology, Delft, The Netherlands

We have assessed the impacts of climate change and evaluated options to adapt irrigation management in the face of predicted changes of agricultural water demand. We have evaluated irrigation scheduling and its effectiveness (versus crop transpiration), and cultivars' adaptability. The spatial and temporal variations of effectiveness and adaptability were studied in an irrigated district of Southern Italy.

Two climate scenarios were considered: reference (1961-90) and future (2021-2050) climate, the former from climatic statistics, and the latter from statistical downscaling of general circulation models (AOGCM). Climatic data consist of daily time series of maximum and minimum temperature, and daily rainfall on a grid with a spatial resolution of 35 km.

The work was carried out in the Destra Sele irrigation scheme (18.000 ha. Twenty-five soil units were identified and their hydrological properties were determined (measured or estimated from texture through pedo-transfer functions). A tomato crop, in a rotation typical of the area, was considered.

A mechanistic model of water flow in the soil-plant-atmosphere system (SWAP) was used to study crop water requirements and water consumption. The model was calibrated and validated in the same area for many different crops. Tomato crop input data and model parameters were estimated on the basis of scientific literature and assumed to be generically representative of the species.

Simulations were performed for reference and future climate, and for different irrigation scheduling options. In all soil units, six levels of irrigation volumes were applied: full irrigation (100%), deficit irrigation (80%, 60%, 40%, 20%), no irrigation. From simulation runs, indicators of soil water availability were calculated, moreover the marginal increases of transpiration per unit of irrigation volume, i.e. the effectiveness of irrigation (ΔT/I), were computed, in both climate scenarios.

Indicators and marginal increases were used to evaluate the tomato crop adaptability to future climate. To this purpose, for several tomato cultivars, threshold values of their yield responses to soil water availability were determined (data from scientific literature). Cultivars' threshold values were evaluated, in all soil units, against the indicators' values, for irrigation levels with different ΔT/I. Less water intensive cultivars and irrigation volumes that optimize transpiration (and yield) could thus be identified in both climate scenarios, and irrigation management scenarios were determined taking into account soils' hydrological properties, crop biodiversity, and efficient use of water resource.

The work was carried out within the Italian national project AGROSCENARI funded by the Ministry for Agricultural, Food and Forest Policies (MIPAAF, D.M. 8608/7303/2008)

Keywords: climate change, adaptation, simulation models, deficit irrigation, water resource efficiency, SWAP