Trend Characterization of the Maize Irrigation Season in Veneto, Italy

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Introduction

Water is an essential agricultural resource that often limits crop yield. The optimization of plant water use, aiming to maximize and stabilize productivity is fundamental for decreasing risks, increasing economic returns, and minimizing environmental impact. This condition contributes to the sustainability of the farming system.

IRRIMANGER ver.1.1 is an easy water balance model developed by Altavia srl in 2001 and is available on ARPAV websites such as IRRIWEB
http://www.arpa.veneto.it/upload_teolo/agrometeo/index.htm).

Irrigation scheduling involves determining when and how much to irrigate. Poor scheduling may lead to a waste of water, energy and labor, low yields and environmental problems. Good scheduling should optimize yield and quality of produce whilst making efficient use of resources.

Methodology

Simulation models: the water balance model is a one-dimensional, daily soil water balance. It aims to simulate the soil water storage and rates of inputs (hourly rainfall, daily evapotranspiration and temperature max, min and mean) and outputs (net irrigation requirement, actual amount of water soil evaporation, crop transpiration, and surface runoff) of water in response to climate. By specifying and selecting a few appropriate crop parameters in a Menu driven environment, the program creates a complete set of parameters that can be displayed and updated if additional information is available. The soil profile may be composed of several soil layers, each with their specific characteristics. At the start of each day of a simulation run, the output of the previous day is displayed at runtime.

Simulation procedures: water balances for maize crop are calculated from 1992. The meteorological inputs required in IRRIMANAGER were obtained from the ARPAV weather station in Legnaro -Padova (Latitude N 45°20’26” and Longitude E 11°58’0”). These parameters included 14 year records of daily maximum and minimum temperatures, wind velocity, sunshine hours, relative humidity, and hourly precipitation. ET0 was calculated using Penman Monteith equation (FAO, 1998): Penman Monteith Method is adopted as it has been accepted as a new standard for reference evapotransipration (FAO, 1998). The soil inputs used in IRRIMANGER were available from field analysis made at the Department of Environmental Agronomy and Crop Science. The hypothetical data of maize’s sowing is fixed on 1st on April for each year.

Results

In the test station annual rainfall averages during 1992 -2006 are about 850 mm. Annual rainfall distribution is changing, in particular during June and July, where the trend is decreasing and August where it is increasing. Monthly averages reference evapotraspiration, during the same period, show an increasing in June and July and a decreasing in July and August (Fig.1); in fact the evaporation is the reverse of the rainfall: in the majority of months, when precipitation occurs, the reference evapotraspiration decreases. This is expected due to the increase in relative humidity, which would cause the evaporation to be less. Consequently, the same situation happens for the simulated values of monthly irrigation needed, starting from 1992: a positive trend during June and July and a negative trend in August, at the end of the growing season, (Fig 2).

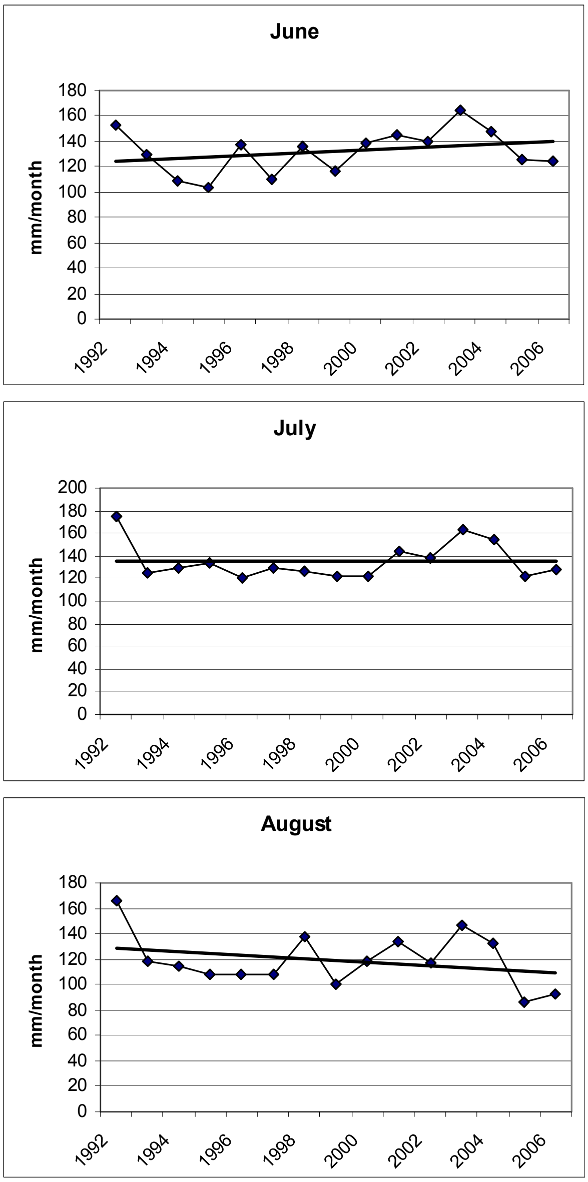

Fig 1 Monthly average Eto 1992-2006

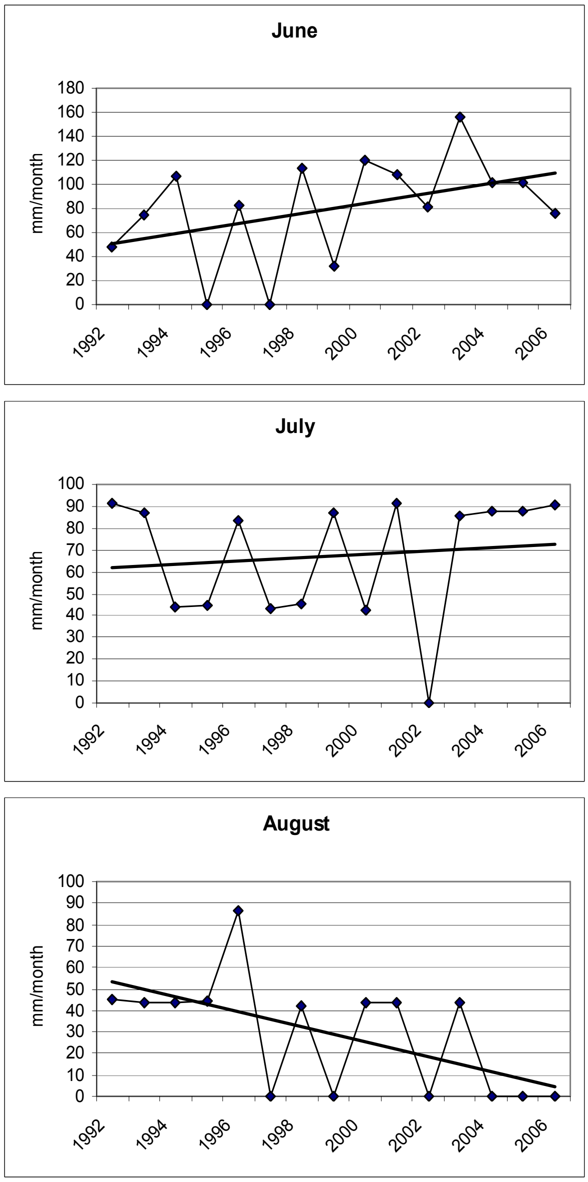

Fig 2 Monthly average Irrigation needed 1992-2006

Conclusions

The scientific management of agriculture is theoretically tested and it is possible to estimate the daily crop water requirement and to adopt the proper scheduling of irrigation. The simulation techniques can be used in different scenarios to identify the strategy that maximizes the effectiveness of irrigation and crop yield. These results help to understand better how global climate change is founded also in a local area and how rainfall's distribution is changing during the growing season that is the most critical period for plant stress. For these reasons defining strategies in planning and management of available water resources in the agricultural sector is to become a national and global priority and IRRIMANGER can support the farmer in them.

References

Allen, R.G., L.S. Pereira, D. Raes and M. Smith. 1998. Crop Evapotranspiration. Guidelines for Computing Crop Water Requirements (FAO Irrigation and Drainage Paper 56). Food and Agric. Organization of the United Nations, Rome, Italy.

Monteith, J. L., 1965: Evaporation and environment. *Symp. Soc. Exp. Biol.*, **19**, 205-234.

Penman, H. L., 1948: Natural evaporation from open water, bare soil and grass. *Proc. Roy. Soc. London*, **A193**, 120-145.