**Optimization of irrigation and fertilization of winter wheat in Tensift Al Haouz (Morocco) using the DSSAT-CERES-Wheat model.**

**Lahoucine Ech-chatir1,2,3, Salah Er-Raki 1,3,4, Julio Cesar Rodriguez 5, Abdelilah Meddich 1;2**

1 Center of Agrobiotechnology and Bioengineering, Research Unit labelled CNRST (Centre AgroBiotech-URL-CNRST-05), Cadi Ayyad University, Marrakesh, 40000, Morocco. (lahoucine.ech-chatir@ced.uca.ma)

2 Laboratory of Agro-Food, Biotechnologies, and Valorization of Plant Bioresources (AGROBIOVAL), Department of Biology, Faculty of Science Semlalia, Cadi Ayyad University, Marrakesh, Morocco. (a.meddich@uca.ma)

3 Laboratory of Processes for Sustainable Energy and Environment (ProcEDE), Department of Applied Physics, Faculty of Science and Technology Guéliz, Cadi Ayyad University, BP 549, Guéliz Marrakesh, Morocco. (s.erraki@uca.ma)

4Center for Remote Sensing Applications (CRSA), Mohammed VI Polytechnic University (UM6P), Benguerir 43150, Morocco

5 Departamento de Agricultura y Ganadería, Universidad de Sonora, Luis Encinas SN, 83000, Hermosillo, Mexico. (julio.rodriguez@unison.mx)

**\*Corresponding author:** s.erraki@uca.ma (S. Er-Raki).

**Abstract**

Improper winter wheat management limits yield, nitrogen and water use efficiency, given the increasing constraints on agricultural productivity in Morocco. The use of crop growth models is a potentially effective tool for evaluating management practices to enhance yields and resource use efficiency. This study focused on using the DSSAT-CERES-Wheat model to identify the best management practices, including irrigation and nitrogen fertilization for winter wheat in semi-arid irrigated Mediterranean conditions. The model previously calibrated and validated on six fields in Tensift Al Haouz (Morocco) over two growing seasons (2002/2003 and 2003/2004) using yield components, phenology and water dynamics was then used to simulate the effect of irrigation, and fertilization amounts on winter wheat grain yield based on 30 years of historical weather data including temperatures, precipitation, wind speed, solar radiation and relative humidity. Water use efficiency *WUE*, irrigation water use efficiency (*IWUE*), nitrogen physiological efficiency (*NPE*), and partial factor productivity of nitrogen (*NPFP*) were employed to identify the most suitable nitrogen and water applications. The results revealed that irrigating winter wheat when soil moisture reaches 50% of total available water capacity results in the highest yield (4.6 t/ha), and applying 300 kg/ha N gives the highest yield (11.6 t/ha) as well as water use efficiency (2.04 kg/m3) for flood-irrigated winter wheat in the region while applying 60 kg N/ha gives the highest NPE and NPFP averages. The model's simulations, once confirmed by field experiments, can be used as a basis for effective crop and resource management.

**Keywords:** DSSAT model, winter wheat, irrigation management, fertilization management.