

## SUSTAINABLE WHEAT PRODUCTION IN MEDITERRANEAN AREAS: CONSIDERING CROP DIVERSIFICATION AS NEW STRATEGY

**C Cantero-Martinez<sup>1</sup>, J Alvaro-Fuentes<sup>2</sup>, J Lampurlanes<sup>3</sup>, JL Arrue<sup>2</sup>, E Pareja-Sanchez<sup>1</sup>, S Franco-Luesma<sup>2</sup>, D Plaza-Bonilla<sup>1</sup>**

<sup>1</sup>*Department of Crop and Forest Sciences, Associated Unit to EEAD-CSIC Agrotecnio, Lleida, Spain*

<sup>2</sup>*Soil and Water Department, Estación Experimental de Aula Dei (EEAD), CSIC, Zaragoza, Spain*

<sup>3</sup>*Department of Agricultural and Forest Engineering, Associated Unit to EEAD-CSIC, Agrotecnio, Lleida, Spain*

Global warming could be one of the future constraints in Mediterranean rainfed areas where wheat and other winter cereal-based cropping systems are traditionally cultivated due to their high adaptation providing economical sustainability to the agricultural sector. However, climate change expectations could further constrain crop yields, which are already limited by both a low annual rainfall (between 250 and 700 mm) and a highly variable rainfall pattern. To date, the strategy for agricultural sustainability in those areas has been focused towards the increase of crop yields and high quality, market-oriented products relying on high amounts of external inputs. This strategy has led to cropping systems depending on intensive tillage, excessive N fertilization and crop monoculture, including long fallow periods, which has resulted in declining crop yields, soil erosion, inefficient water use, higher susceptibility to pests, diseases and weeds and other negative environmental effects such as loss of biodiversity. Several studies have pointed out that soil tillage reduction, adapted genotypes, N fertilization optimization, and plant sowing date represent key strategies for the sustainability of Mediterranean cropping systems but few of them propose to assess crop diversification as a key approach for achieving farming systems sustainability. Indeed plant breeding programs are solely based on high input systems, and the varieties obtained are often recommended to be used in all systems. Current cropping and farming systems in Mediterranean rainfed areas need to be redesigned by increasing crop diversification in order to improve their efficiency in the use of natural abiotic resources (soil, water and nutrients). It is expected that this approach will lead to sustainable yield production and protection against pests, diseases and weeds, and will preserve farmers' health and economy, making the cropping system more resilient to climate change. The work shows, through results from different long-term experiments and some insights on crop rotation performance in commercial farms, how the adoption of conservation tillage, rational use of N fertilizers, sowing date delay and crop diversification, as an integrated cropping system approach, can make wheat-based production systems more sustainable under Mediterranean conditions.