



## Simple, spatial and predictive approach for cereal yield prediction in the semi-arid areas

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The objective is to develop a simple, spatial and predictive approach of dry matter (DM) and grain yield (GY) of cereal in the semi-arid areas. The proposed method is based on the three efficiencies model of Monteith (1972). This approach summarizes the transformation of solar radiation to the dry matter (DM) by the climate ( $\varepsilon_c$ ), interception ( $\varepsilon_i$ ) and conversion ( $\varepsilon_{conv}$ ) efficiencies. The method combines the maximum of  $\varepsilon_i$  and  $\varepsilon_{conv}$  (noted  $\varepsilon_{imax}$  and  $\varepsilon_{convmax}$ ) into a single parameter denoted  $\varepsilon_{max}$ , calculating as a function of cumulating growing degree day (CGDD). Also, the stress coefficient  $k_s$ , which affects the conversion of solar radiation to the biomass was calculated by the surface temperature or the water balance at the root zone. In addition, the expression of  $k_s$  has been improved by the consideration of the results achieved by deficit irrigation (AquaCrop and STICS models) which showed that the value of  $k_s$  from 0.7 to 1 didn't affect significantly the cereal production. For the partitioning of the dry matter developed, between straw and grain, the method proposed calculates a variable Harvest Index coefficient (HI). HI is deducted from CGDD and  $HI_{0max}$  (maximal final harvest Index in the region of study). Finally, the approach calculates DM depending Satellite Information (NDVI and surface temperature  $T_s$ ) and climatic data (solar radiation and air temperature). In the case of no availability of  $T_s$ , the amount of irrigation is required to calculate  $k_s$ .

Until now, the developed model has been calibrated and validated on the irrigated area R3, located 40 Km east of Marrakech. The evolutions of DM and GY were reproduced satisfactorily.  $R^2$  and RMSE are respectively 0.98 and 0.35 t/ha and 0.98 and 0.19 t/ha, respectively. Currently, additional tests are in progress on data relating to the Kairouan plain of Tunisia.