



Measurements and simulations with the crop growth model VICMOTO in Nebbiolo vineyards

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Agricultural production is substantially affected by weather variability, and recently threatened by climate change. Despite its good resistance to adverse meteorological conditions, this is true also for vineyard. Thus, it is fundamental to understand how and how much meteorology and climate influence crop (grape) productivity and quality. In the frame of a multiannual collaborative project between privates and academy, the numerical crop growth model VICMOTO (VIneyard Crop MOdel of university of TORino) has been recently developed in order to answer part of the question. Specifically, the goal was to evaluate the effects of micrometeorological conditions on vine growth and grape quality. VICMOTO, developed in FORTRAN language at the Department of Physics of the University of Torino, simulates physiological and phenological vineyard conditions during the vegetative season of vine plants, allowing the knowledge of microscale plant processes and their responses to environmental forcing. In particular, the main model outputs are the predawn leaf water potential, the principal phenological phases, the leaf surface development, the plant yield, and the grape sugar concentration.

Three experimental plots belonging to a vineyard located in the renowned wine zone of Barolo (a sub-region of the Langhe area, located in the Piedmont region, in NW Italy) has been selected and equipped with sensors located within and above vegetation, and in the soil, to monitor the main variables able to influence grape growth. In parallel, a specific advanced experimental campaign has been performed within the same vineyard during the 2016-2018 vegetative seasons, by directly measuring pheno-physiological variables. All data were used in part to feed the model as boundary conditions, and in part to calibrate and validate its outputs.

The boundary meteorological conditions required by VICMOTO during the simulation are the following physical quantities: temperature and relative humidity of the air above the vegetation, solar global radiation, photosynthetically active radiation, soil temperature and water content in the root zone, wind speed and direction above the vegetation, rainfall, and leaf wetness. In addition to the geographical information, VICMOTO also requires some initial and boundary conditions related to vineyard and soil characteristics: soil texture, plant density, varietal characteristics, and vineyards management procedures.

In this occasion, the main results of the intercomparison between in field measured data and simulated data will be presented and discussed, after a short introduction about the VICMOTO model.