Impacts of extreme events on grapevine: experimental and modeling activities

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In the recent years, climate change showed a great impact on crop growth and development. In the specific case of grapevine, the growth cycle results affected by short-term climate variability and long-term climate change. In this context, changes in the frequency of extreme events play a key role on grape phenology and yield. The higher frequency of cold spells, heat waves and droughts expected in future climatic conditions will affect grapevine phenology and will increase yield loss risks. As an example, frost events (Tmin <-2°C) at bud-break may cause shoot loss and lower yield and fruit set may be strongly reduced by temperatures higher than 38°C due to the inhibition of pollen growth tube and ovule fertility. In this context, also prolonged drought period alters the assimilate distribution pattern of biomass towards trunk and roots showing reduced shoot length and smaller leaves. On these premises, crop simulation models represent useful tools for evaluating the impact of mean climate change on crop growth and development. Accordingly, Bindi et al. (1997) proposed a simplified approach of simulation model for estimating grapevine yield, growth and development. The model is characterized by the simulation of four main processes: phenology, leaf development, biomass accumulation and fruit growth. In this way, the introduction of the grape model in a modular software platform (BioMA: Biophysical Model Application) may be useful for introducing new aspects as well as phenology, biomass partitioning, nitrogen balance and extreme events effect with the purpose of using grape model in operational applications. In this case, the discretization of a complex model into simpler components permits to obtain a fine-granularity that make easier the model implementation and the simulation of additional processes such as chilling unit requirement, biomass partitioning, nitrogen balance and extreme event effect.