Geophysical Research Abstracts
Vol. 16, EGU2014-6664, 2014
EGU General Assembly 2014

Modelling Growth and Partitioning of Annual Above-Ground Vegetative and Reproductive Biomass of Grapevine

Franco Meggio, Nadia Vendrame, Giovanni Maniero, and Andrea Pitacco

Dept. of Agronomy Food Natural resources Animals and Environment - DAFNAE, University of Padova, Legnaro (PD), Italy (franco.meggio@unipd.it)

In the current climate change scenarios, both agriculture and forestry inherently may act as carbon sinks and consequently can play a key role in limiting global warming. An urgent need exists to understand which land uses and land resource types have the greatest potential to mitigate greenhouse gas (GHG) emissions contributing to global change. A common believe is that agricultural fields cannot be net carbon sinks due to many technical inputs and repeated disturbances of upper soil layers that all contribute to a substantial loss both of the old and newly-synthesized organic matter. Perennial tree crops (vineyards and orchards), however, can behave differently: they grow a permanent woody structure, stand undisturbed in the same field for decades, originate a woody pruning debris, and are often grass-covered.

In this context, reliable methods for quantifying and modelling emissions and carbon sequestration are required. Carbon stock changes are calculated by multiplying the difference in oven dry weight of biomass increments and losses with the appropriate carbon fraction. These data are relatively scant, and more information is needed on vineyard management practices and how they impact vineyard C sequestration and GHG emissions in order to generate an accurate vineyard GHG footprint. During the last decades, research efforts have been made for estimating the vineyard carbon budget and its allocation pattern since it is crucial to better understand how grapevines control the distribution of acquired resources in response to variation in environmental growth conditions and agronomic practices.

The objective of the present study was to model and compare the dynamics of current year's above-ground biomass among four grapevine varieties. Trials were carried out over three growing seasons in field conditions. The non-linear extra-sums-of-squares method demonstrated to be a feasible way of growth models comparison to statistically assess significant differences among grapevine cultivars and years. The results of this study enabled the development of carbon allocation functions of year's above-ground biomass in grapevine. Statistical analyses highlighted key patterns and main drivers involved in the genotypic (genetic factors, cultivar) and phenotypic variability (environmental factors or differences in cultural practices among years) of shoot growth.

These results suggest that some caution should be taken when incorporating shoot development and carbon partitioning coefficients in a growth model. Use of common coefficients estimates for all cultivars for dynamic modelling approaches, in fact, may result in a poor representation of the data early or late during the course of the season. The present study may be considered also as a potential database for both the validation of measurements made in vineyards by micrometeorological methods, such as eddy covariance or provide the lack of information coming from life cycle assessment methods recently adapted also to the wine supply chain for carbon footprint assessment.