

P-008: Sensor application in grapevine breeding

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Due to its perennial nature and size, the acquisition of phenotypic data in grapevine research is for the most part restricted to the field. Techniques to assess phenology and morphology traits are mostly based on visual scoring. Some traits like biotic and abiotic stress and especially quality traits are evaluated by invasive measurements. The new arising sensor technologies make non-destructive evaluations of phenotypic traits available for grapevine research by using different sensors and sensor platforms, from greenhouse and lab application to the field application. Varying outdoor light conditions and background used to be the biggest environmental impact and challenge for field phenotyping of grapevines.

Facing these problems the presented Phenoliner is a new type of ground based, robust field phenotyping platform. Following the concept of a movable tunnel, the vehicle is based on a grape harvester. It is equipped with different sensor systems within the tunnel (multi-camera system, hyperspectral cameras) and above (RTK-GPS, orientation and speed sensors). Through an artificial light source in the tunnel it is independent from external light conditions. In combination with the artificial background the Phenoliner allows standardised acquisition of high-quality, geo-referenced sensor data. The multi-camera system is used for the automated acquisition of colored 3D data of multiple vine rows for the automated calculation of yield parameters (number of grape bunches and berries, berry size) to be used for yield prediction. The hyperspectral cameras are used to detect spectral data in a broad range of spectral bands covering a spectrum from 400 nm to 2,500 nm to evaluate e.g the health status.

The Phenoliner can be used for a high-throughput, automatic and non-invasive acquisition of phenotypic data directly in the field. It allows a fast, robust and precise screening of grapevines for several traits. The given platform can be extended through further sensors at any given time. The hyperspectral system is also used for lab screening applications. Further phenotyping tools, e.g. based on 3D point clouds, can be used to describe cluster architecture or other traits thus improving breeding efficiency.