

Setup of a phenotyping pipeline in grapevine breeding

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The acquisition of phenotypic data in grapevine breeding is usually done directly in the field by visual estimations. In general OIV descriptors or the BBCH scale are applied to assess the phenotypes into classes. The phenotyping is strongly limited by time, costs and the subjectivity of records. Due to that limitation, objectivity, automation and precision of phenotypic data evaluation is crucial in order to 1) reduce the consisting phenotyping bottleneck, 2) increase the efficiency of grapevine breeding, 3) enable further important genetic research and 4) assure improved vineyard management.

For these purposes a phenotyping pipeline was setup and tested in a plot of genetic resources. It ranges from the automated image acquisition directly in the field using the PHENObot, to data management, data analysis and the interpretation of gained phenotypic data for grapevine breeding aims. The PHENObot, consists of an automated guided vehicle system, a calibrated camera system, a Real-Time-Kinematic GPS system and a computer for image acquisition and image storage.

Specifically developed software was applied in order to capture geo referenced images directly in the vineyard. The geo reference is afterwards used for the post-processing data management in a database. As phenotypic traits are to be analyzed within the phenotyping pipeline the detection of berries and the determination of the berry size and color were considered.

The application of the phenotyping pipeline enables the fast acquisition of image data from at least 250 individual grapevines per hour directly in the field, using the PHENObot, and represents the basis for high-throughput, automated and non-invasive data sampling in the field. The following automated analysis of these images using Matlab[®] permits the generation of objective and precise phenotypic data.